

FIG. 1

TOP SECRET

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UNCOUPLED - Desired			
	DP1	DP2	DP3
FR1	X	0	0
FR2	0	X	0
FR3	0	0	X

DECOUPLED - Acceptable			
	DP1	DP2	DP3
FR1	X	0	0
FR2	X	X	0
FR3	X	X	X

COUPLED - Undesired			
	DP1	DP2	DP3
FR1	X	X	X
FR2	X	X	X
FR3	X	X	X

FIG. 2

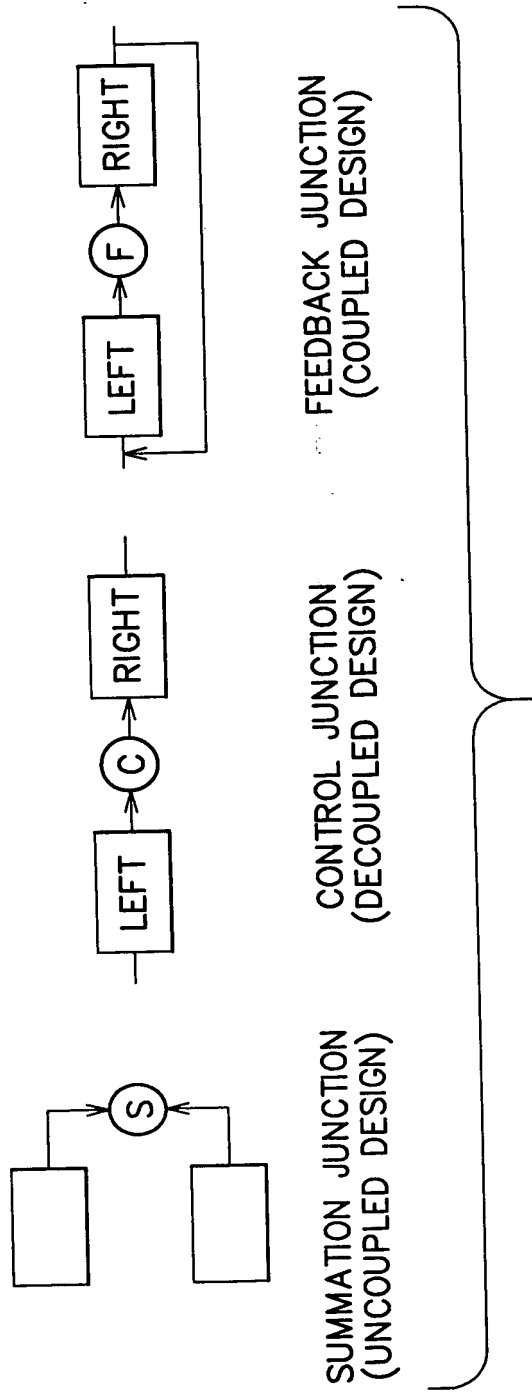


FIG. 3

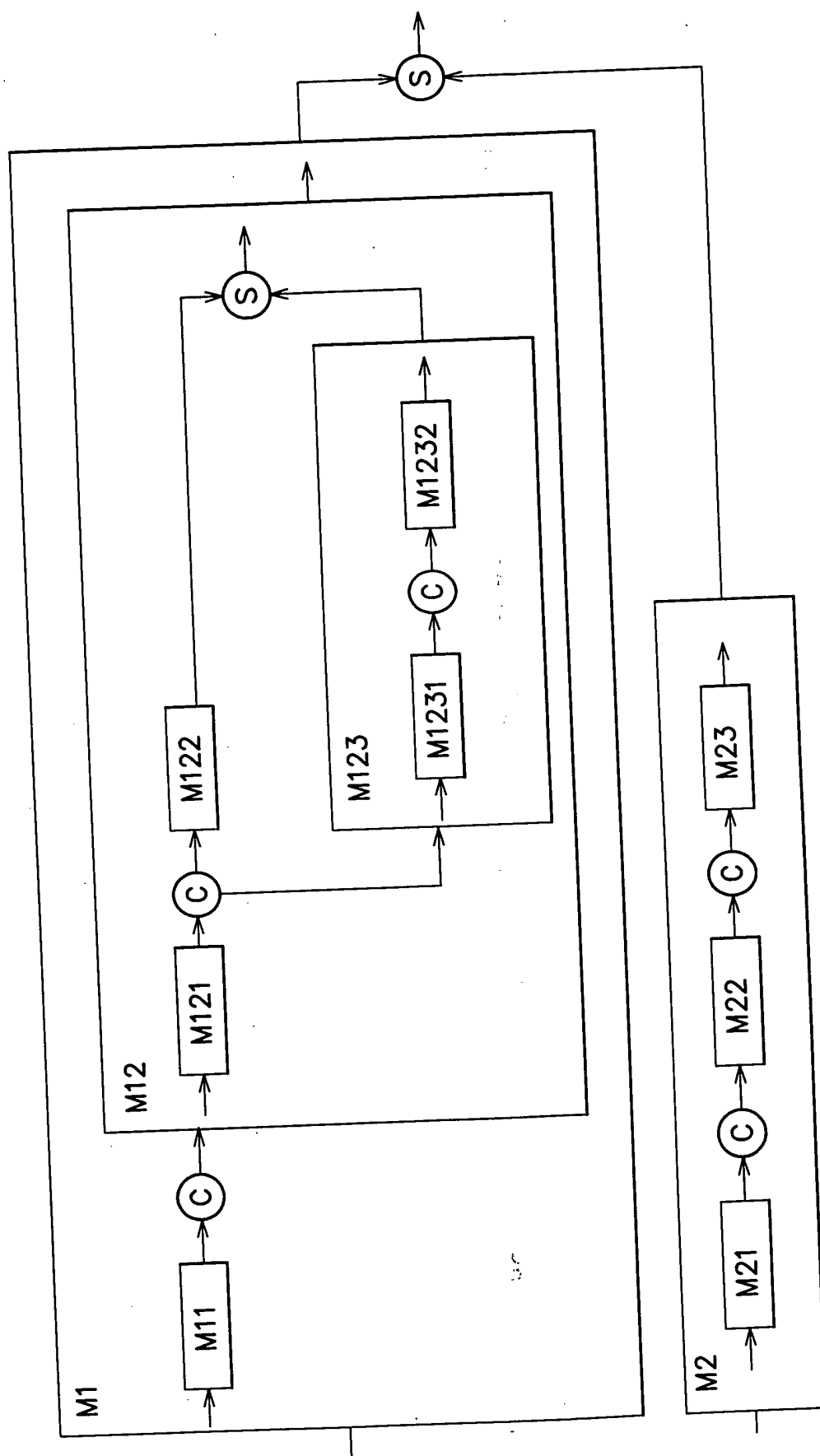


FIG. 4

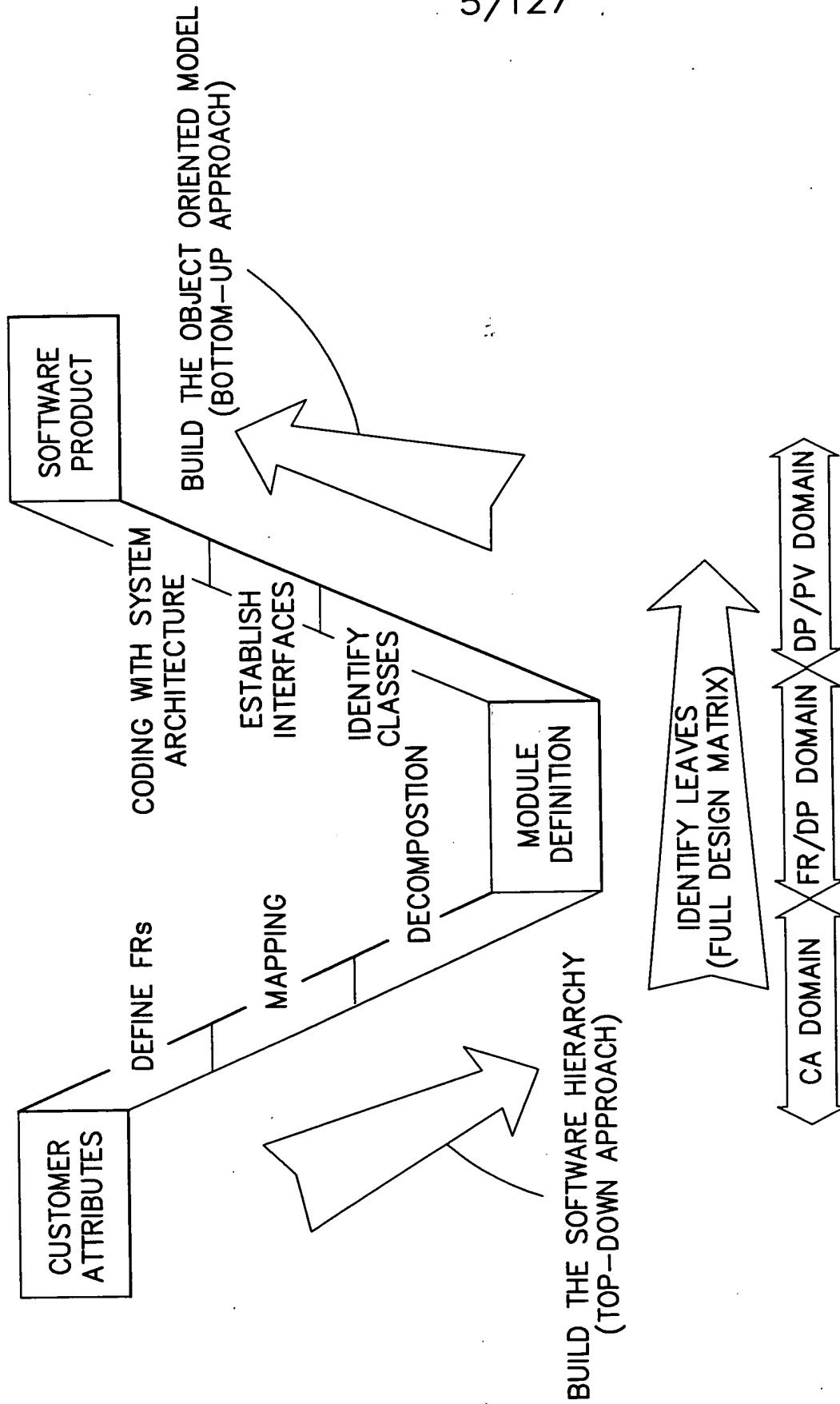


FIG. 5

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OBJECT (=FR)
ATTRIBUTES/ DATA STRUCTURE (=DP)
METHOD (FR <sub>i</sub> = A <sub>ji</sub> DP <sub>j</sub> )

*FIG. 6*

0973463-044601  
T09T40-829TE260

CLASS:

CLASS NAME

CLASS NAME
attribute attribute:data_type attribute:data_type=init_value ...
operation operation(arg_list): return_type ...

MULTIPLICITY OF ASSOCIATIONS:

— CLASS EXACTLY ONE

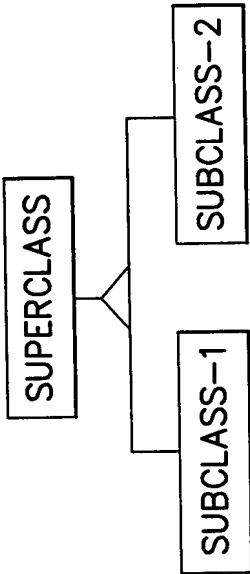
— CLASS MANY (ZERO OR MORE)

— CLASS OPTIONAL (ZERO OR ONE)

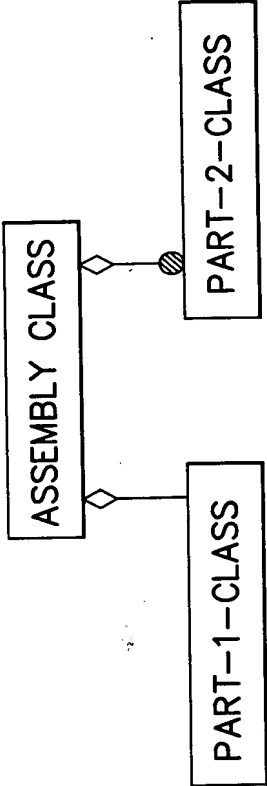
1+ CLASS ONE OR MORE

1-2,4 CLASS NUMERICALLY SPECIFIED

GENERALIZATION (INHERITANCE):



AGGREGATION:



ASSOCIATION:

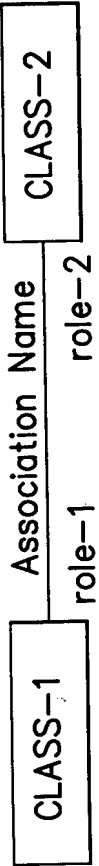


FIG. 7

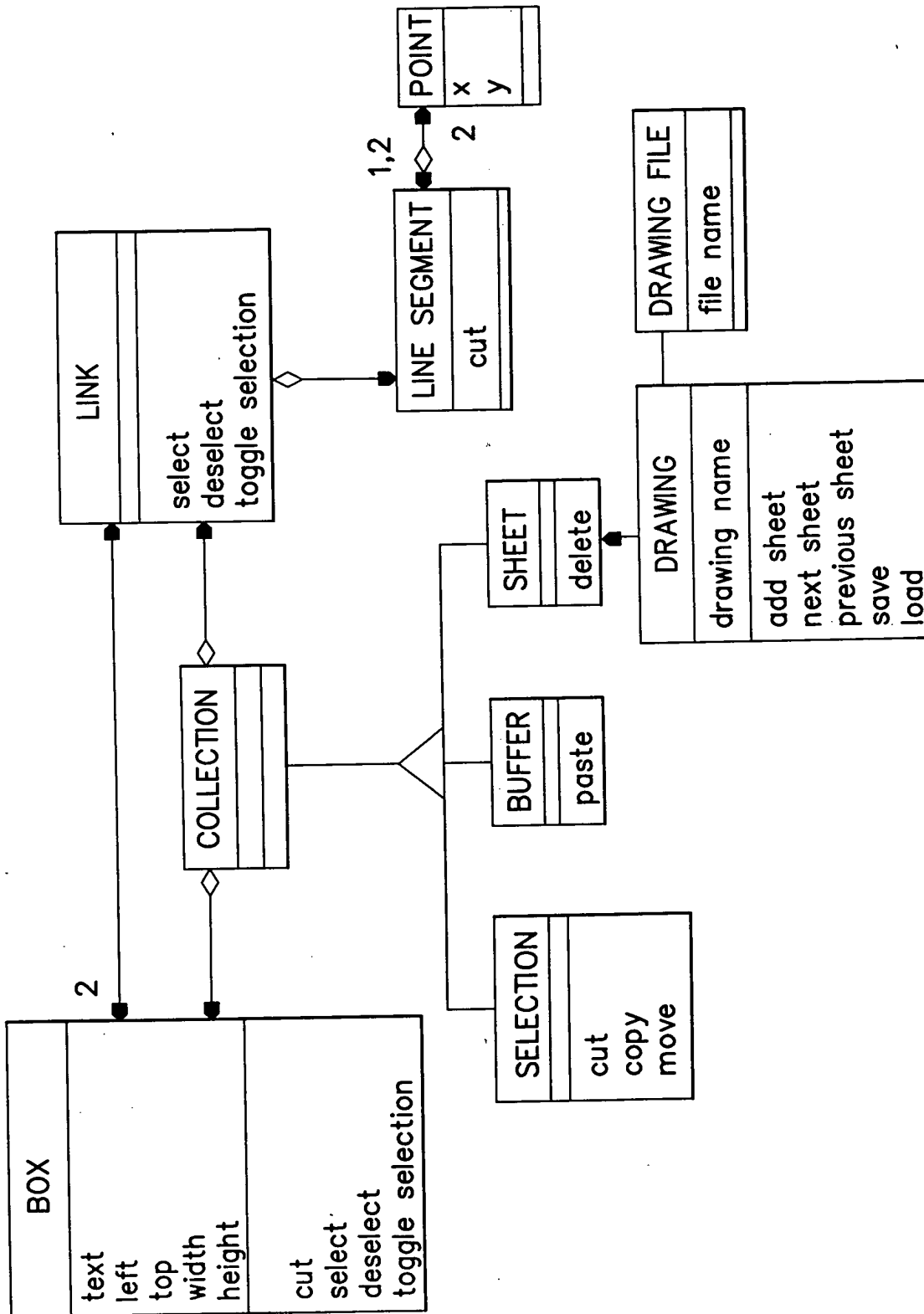
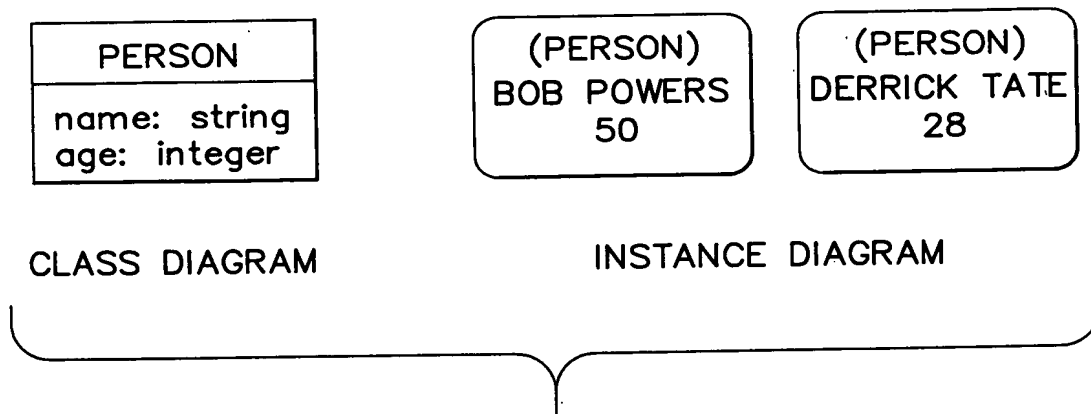
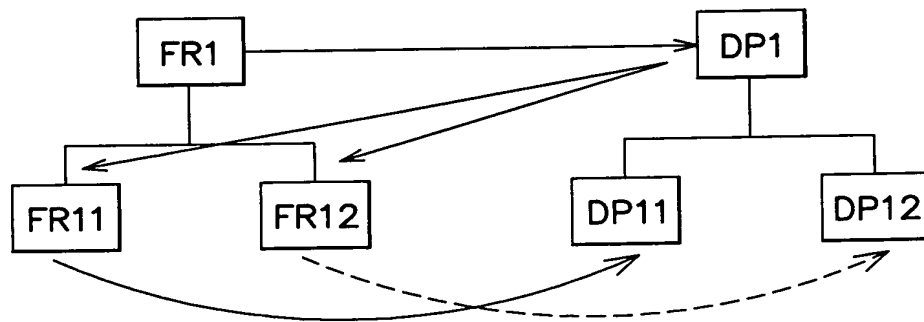


FIG. 8



*FIG. 9**FIG. 10*

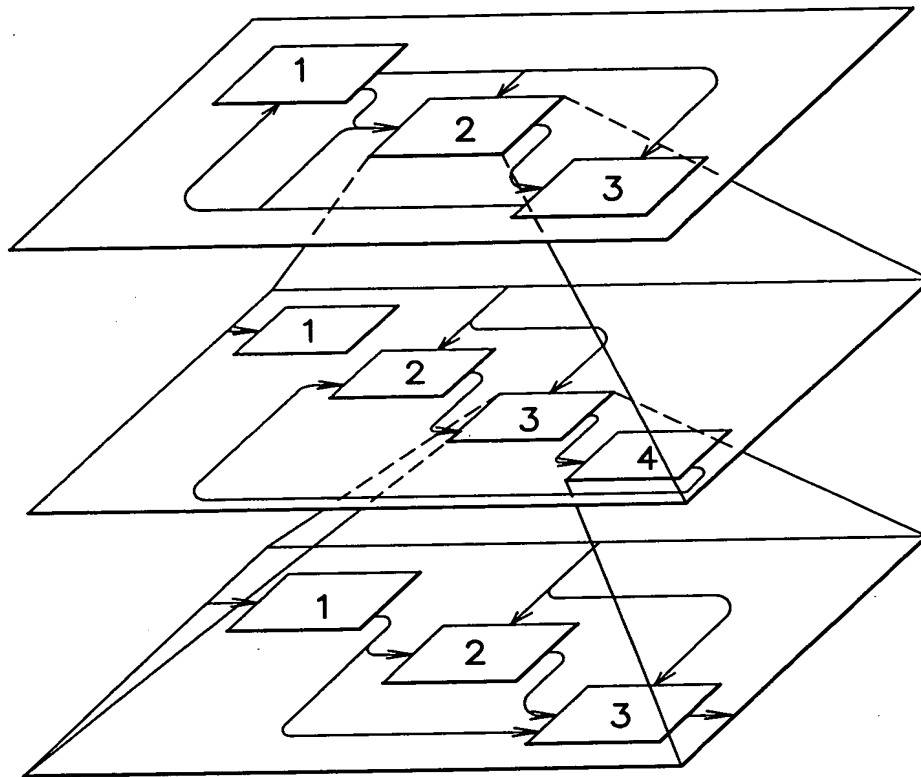
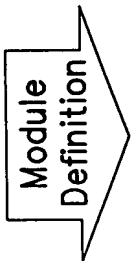
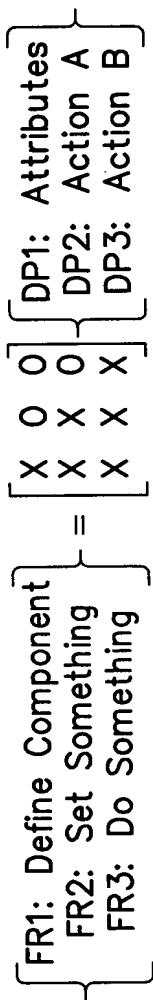


FIG. 11

09734578-04501  
T09T40-B29TE260



The number of total attributes are 4 for this class.

These two attributes are used by all methods.

	DP1: Attributes	DP2: Action A	DP3: Action B	
FR1: Define component	uPortPinsUp, uPinsUpSensor			
FR2: Set something	uStatus	SetState()		Module for FR2
FR3: Do something	uTime	X	ProcessLoop()	Module for FR3

This attribute is only used by SetState() method.

ProcessLoop() method calls SetState() method.

FIG. 12

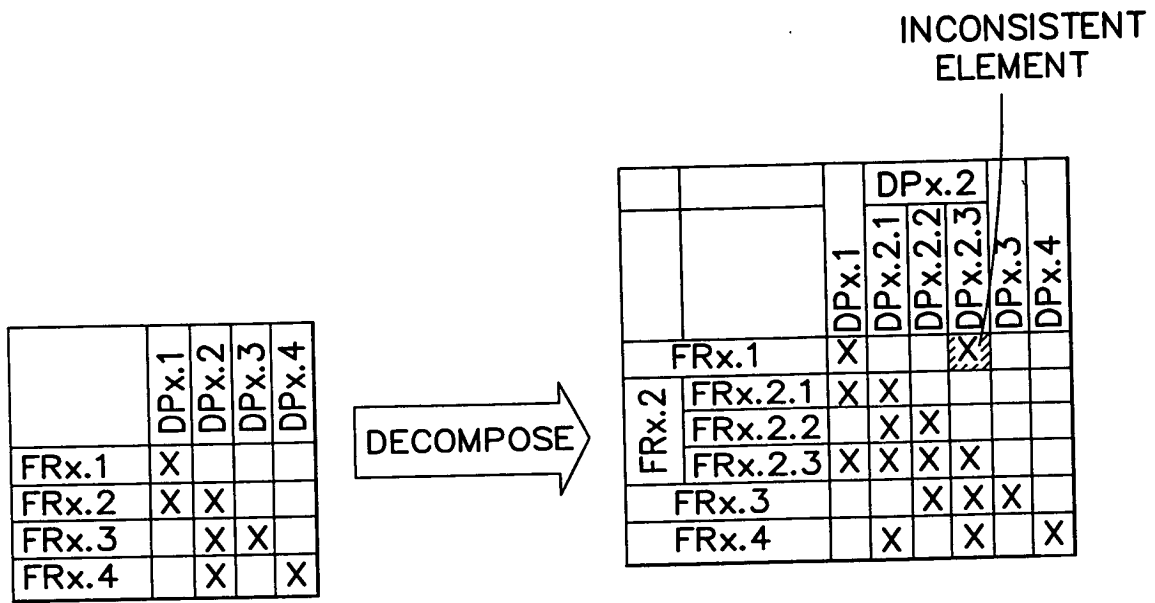


FIG. 13

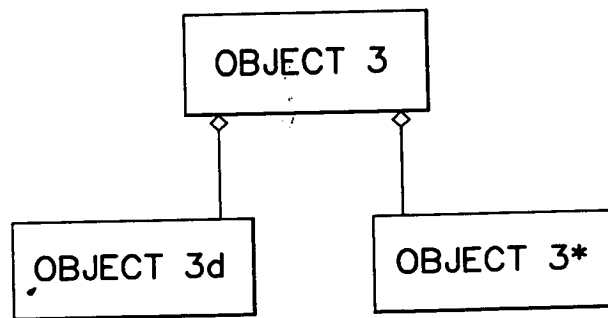
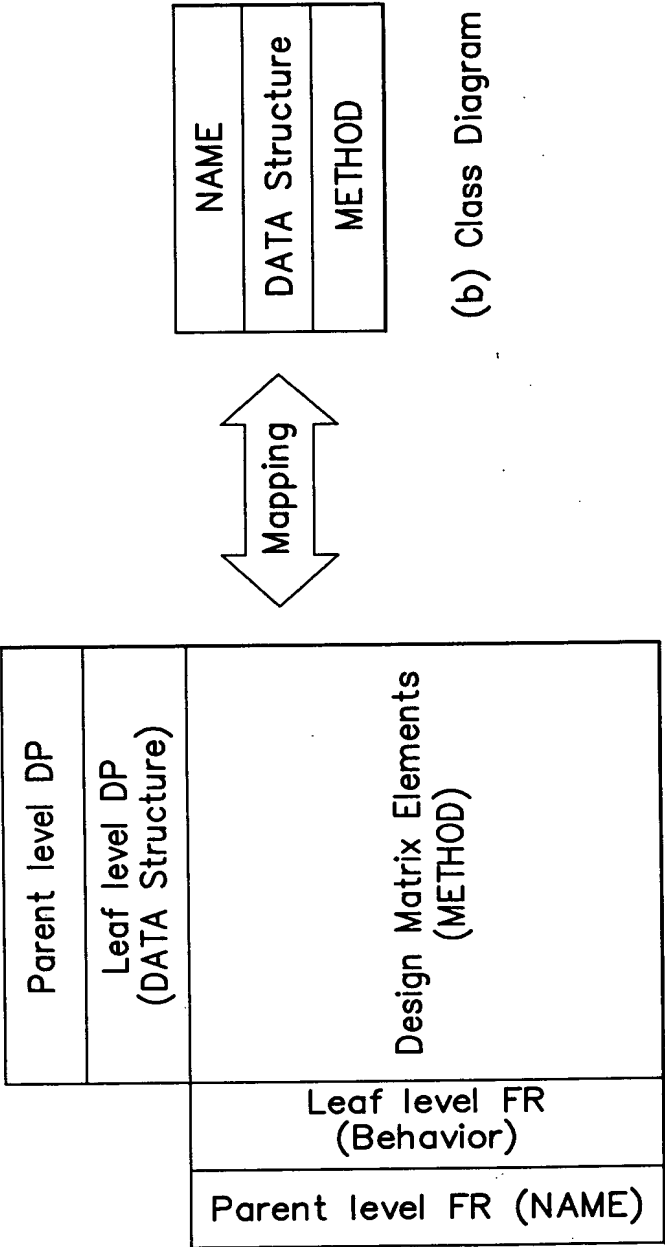


FIG. 14



(b) Class Diagram

(a) Full Design Matrix Table

FIG. 15

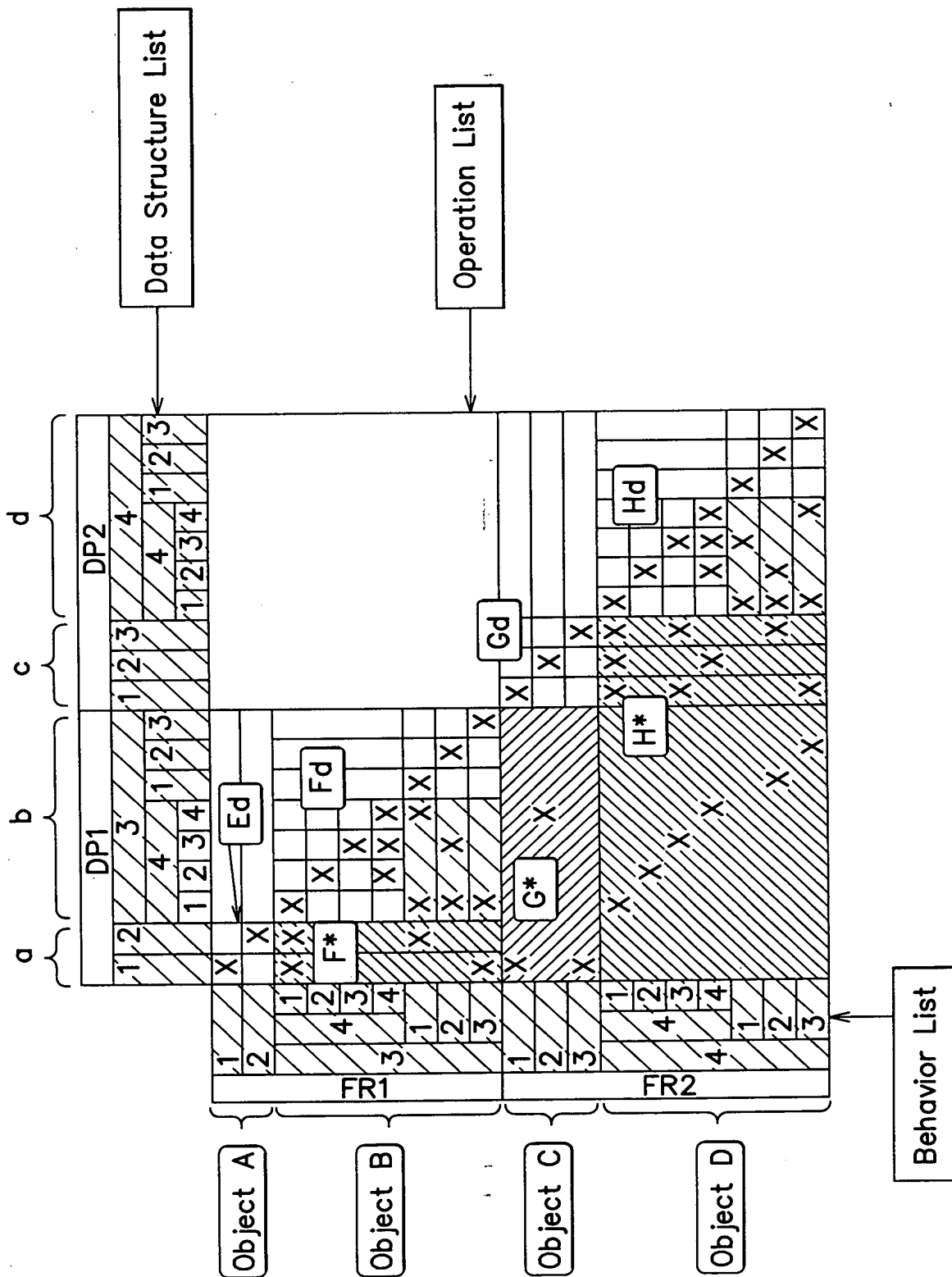


FIG. 16

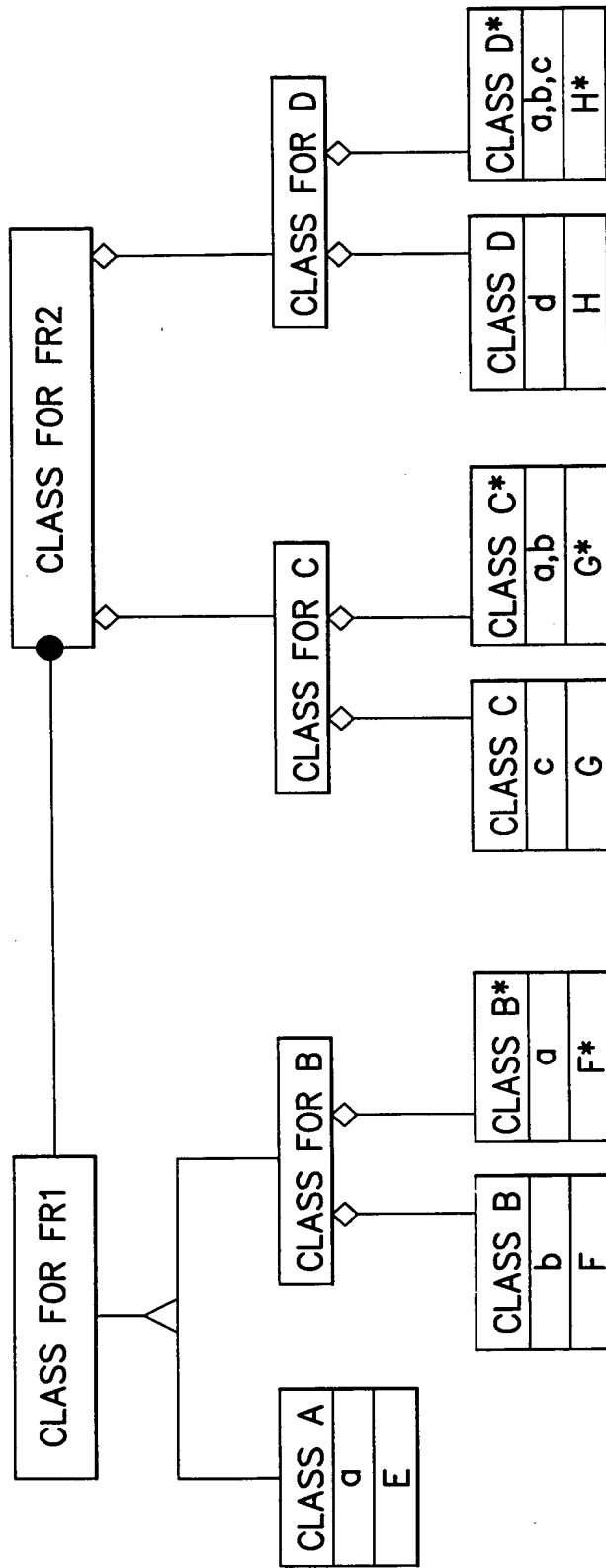
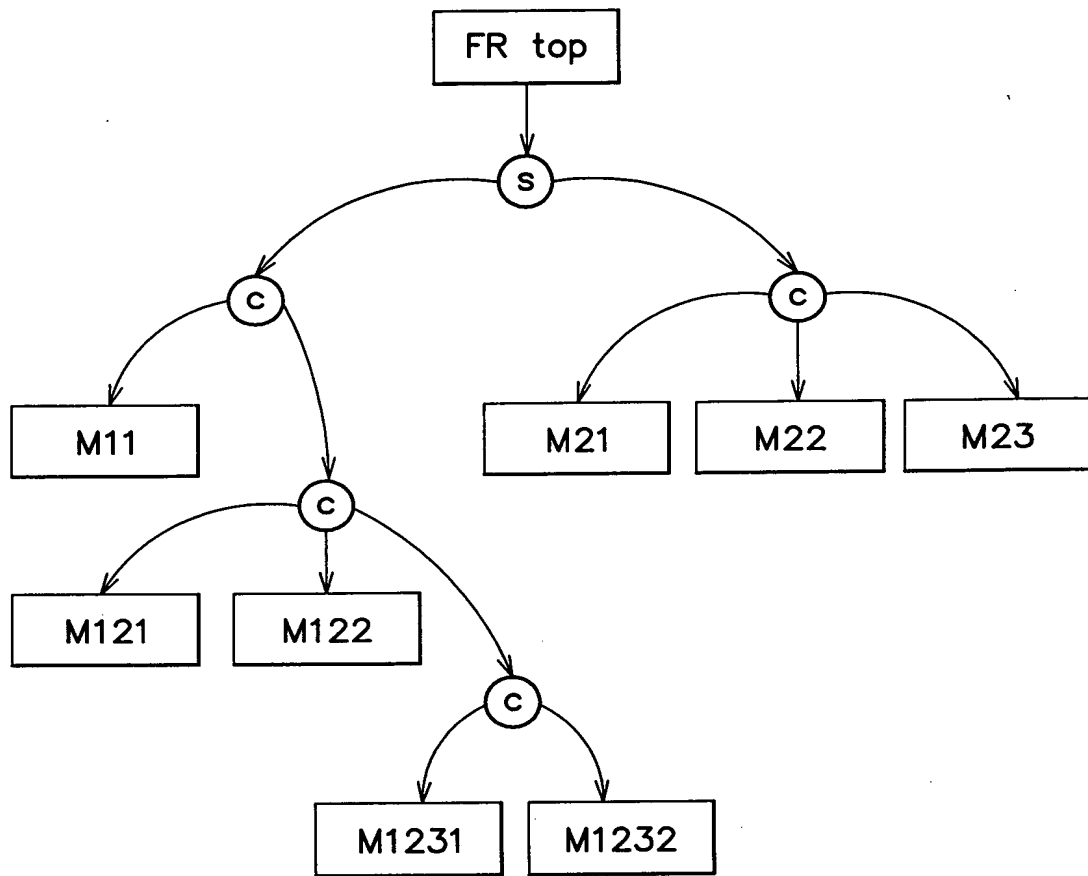


FIG. 17

*FIG. 18*



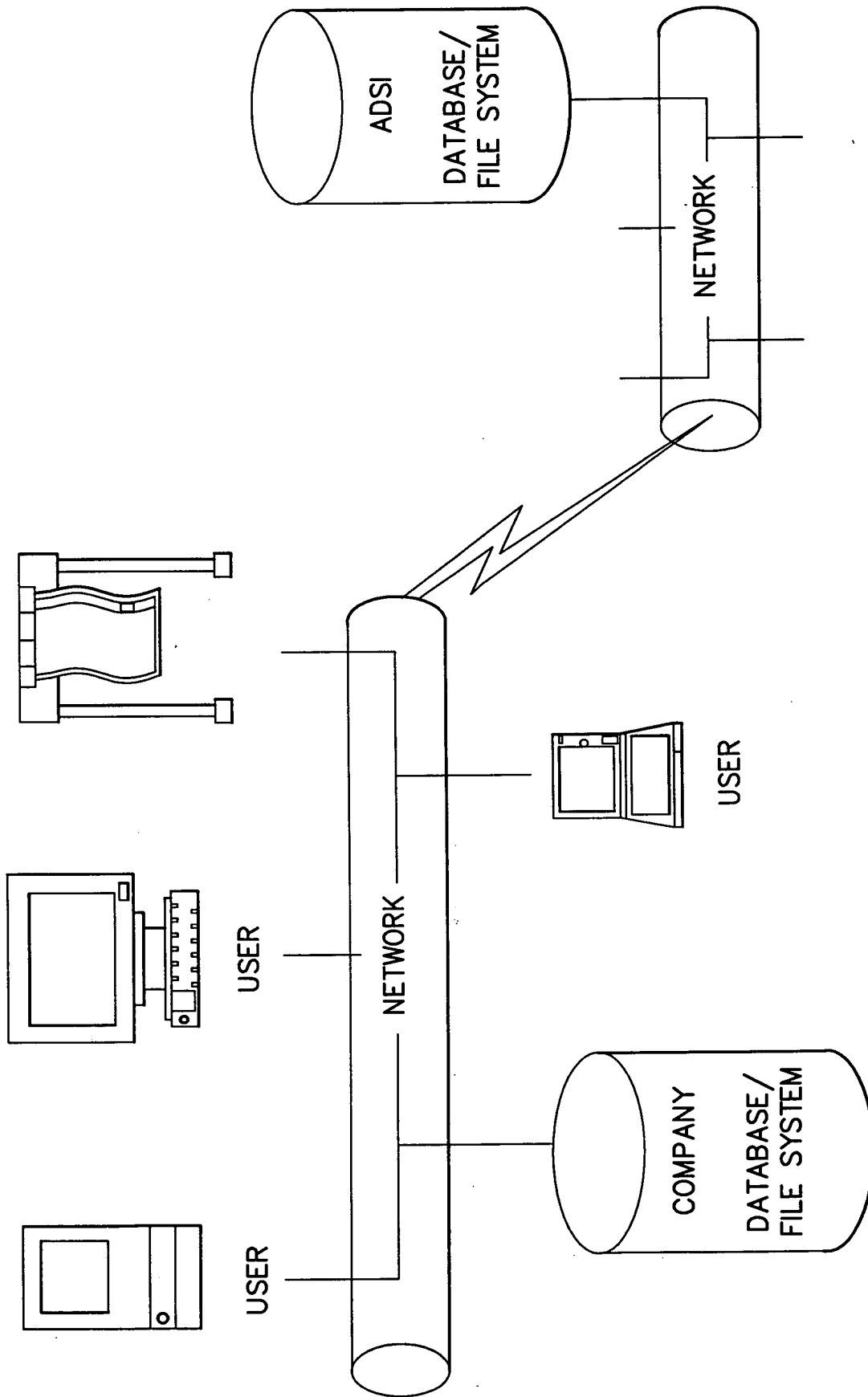


FIG. 19

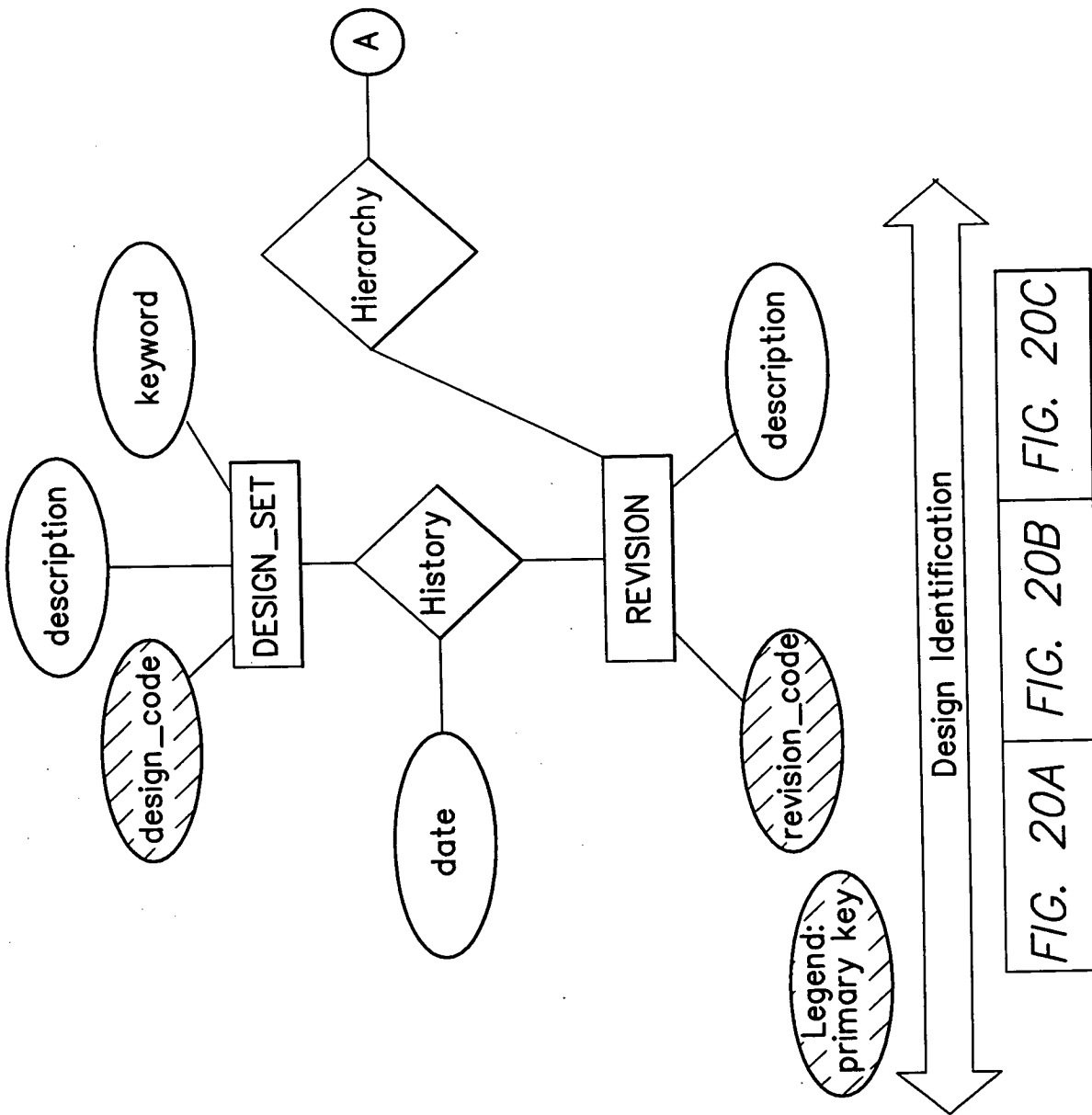
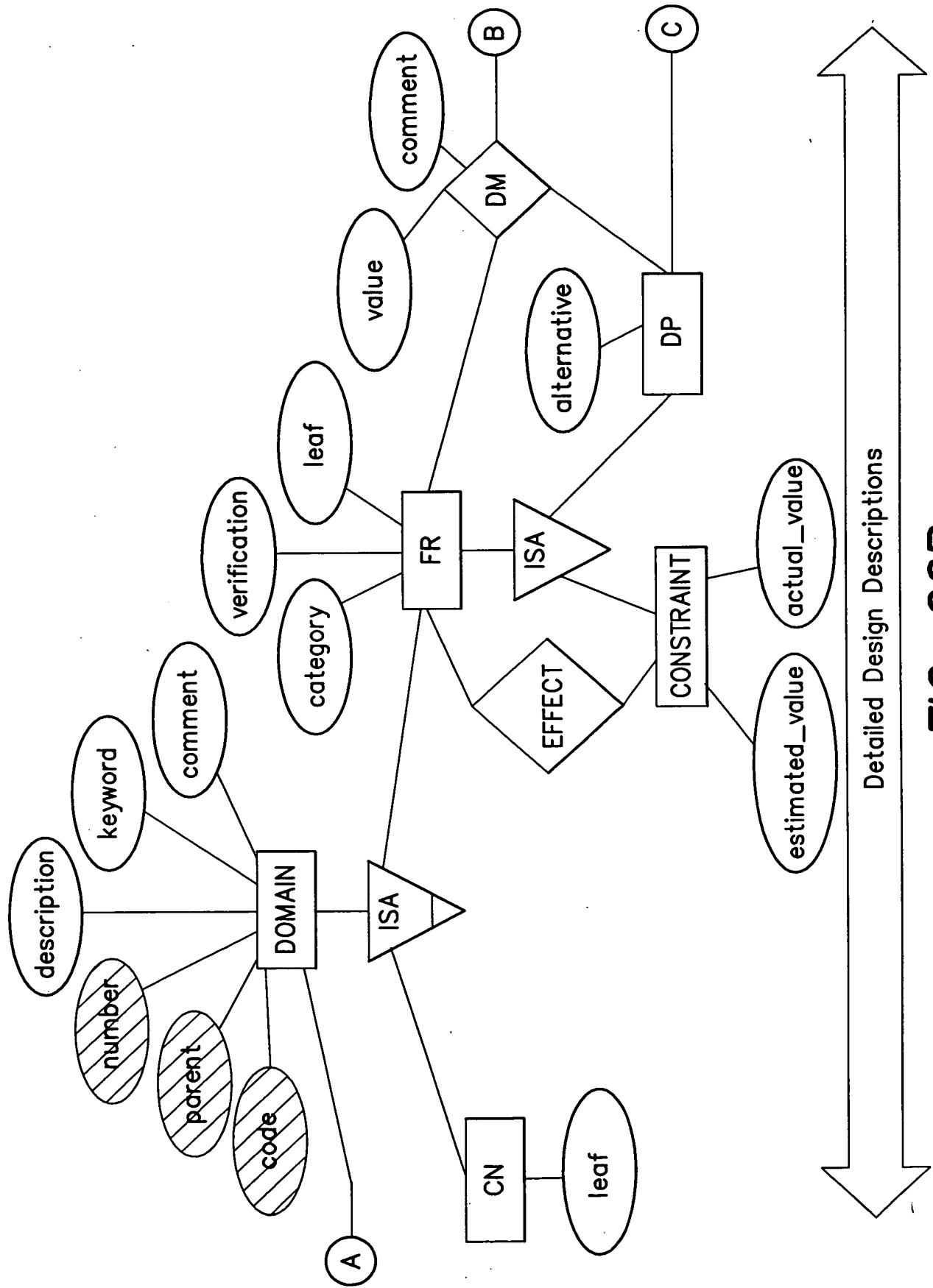
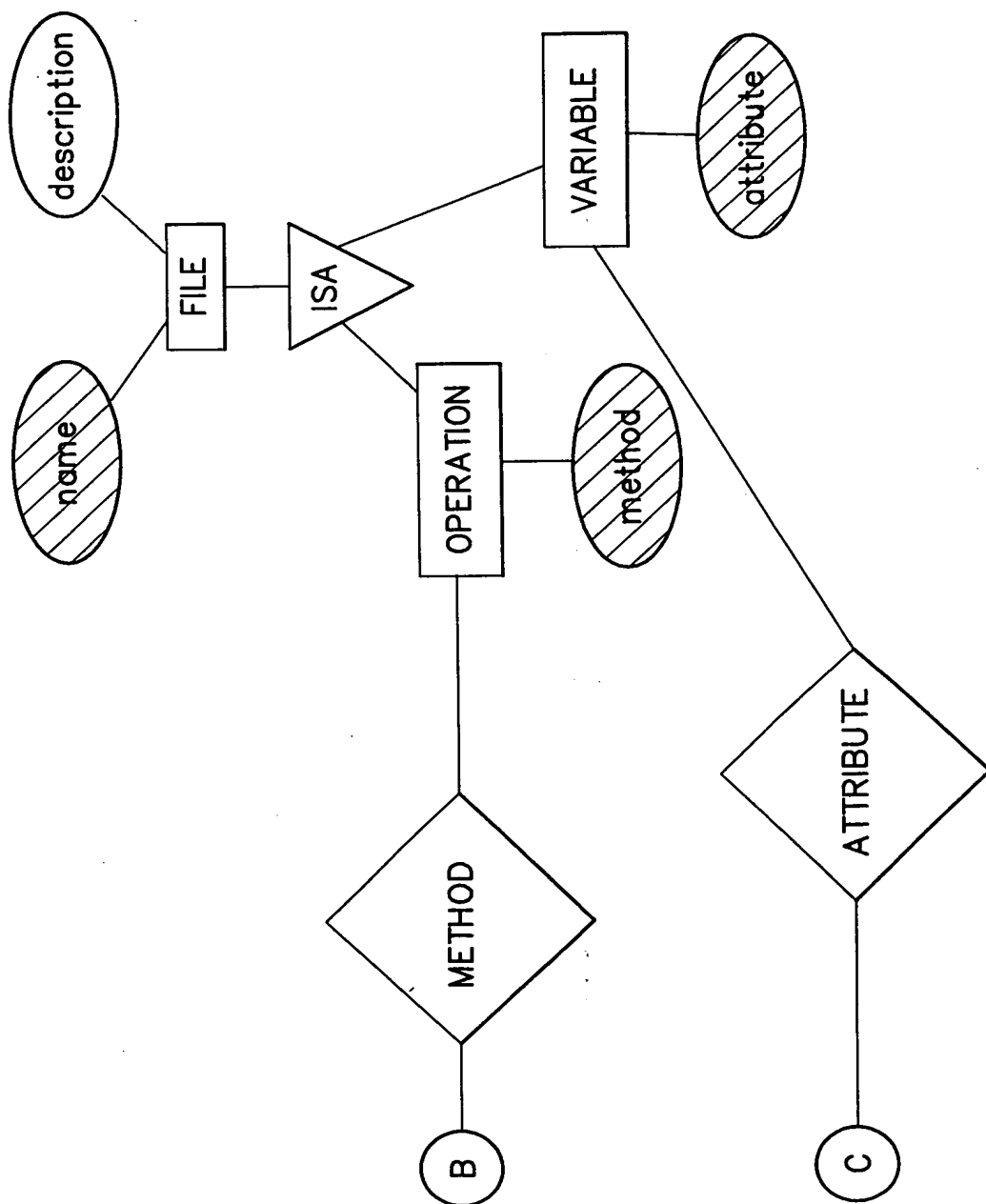


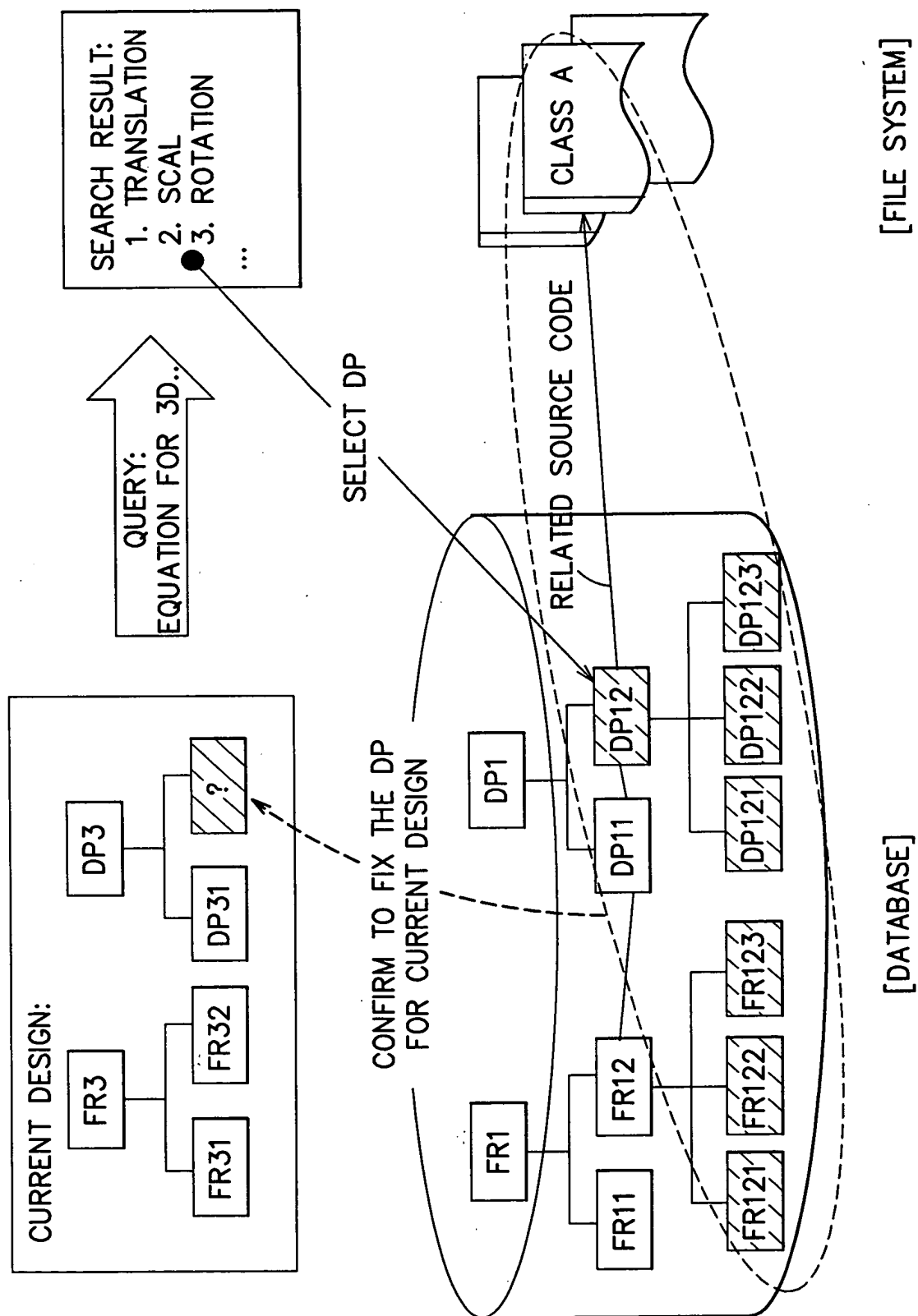
FIG. 20A





Source Code Information

FIG. 20C



**FIG. 21**

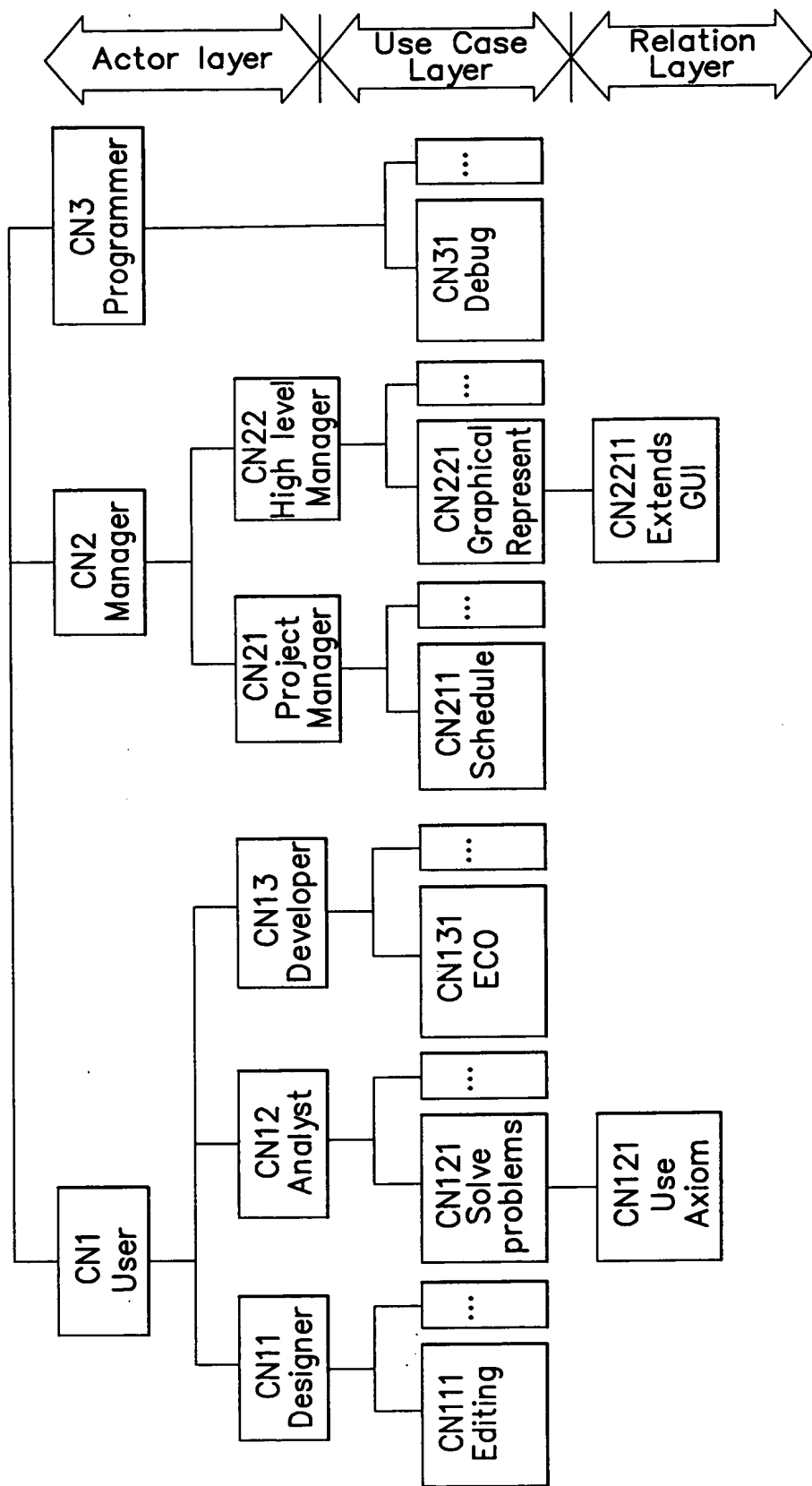
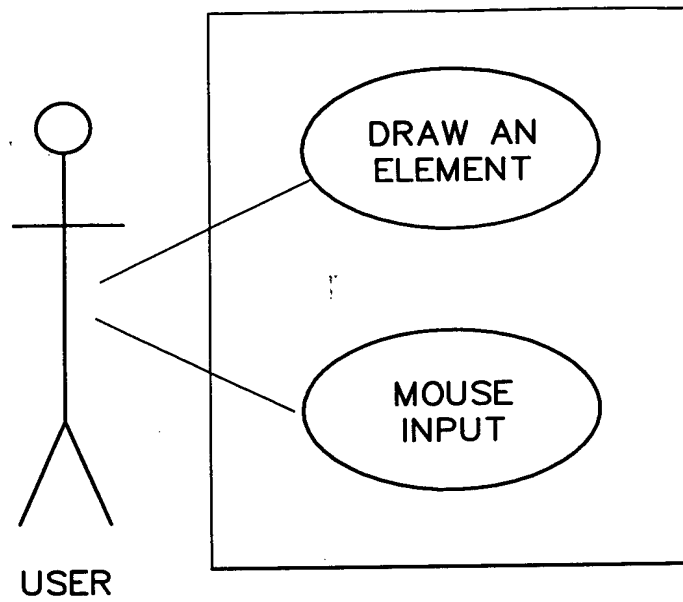


FIG. 22

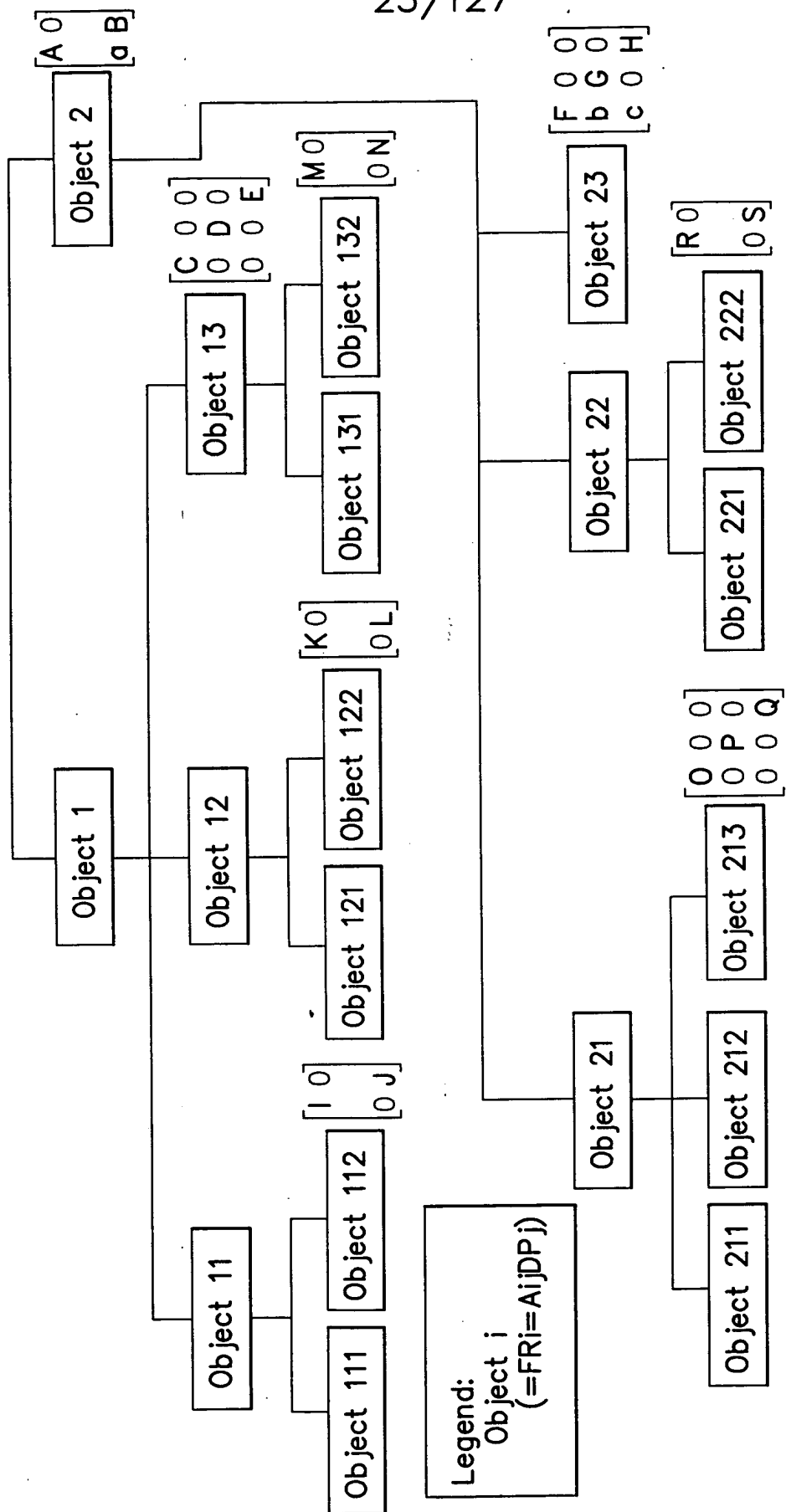
FIG. 22





**FIG. 24**







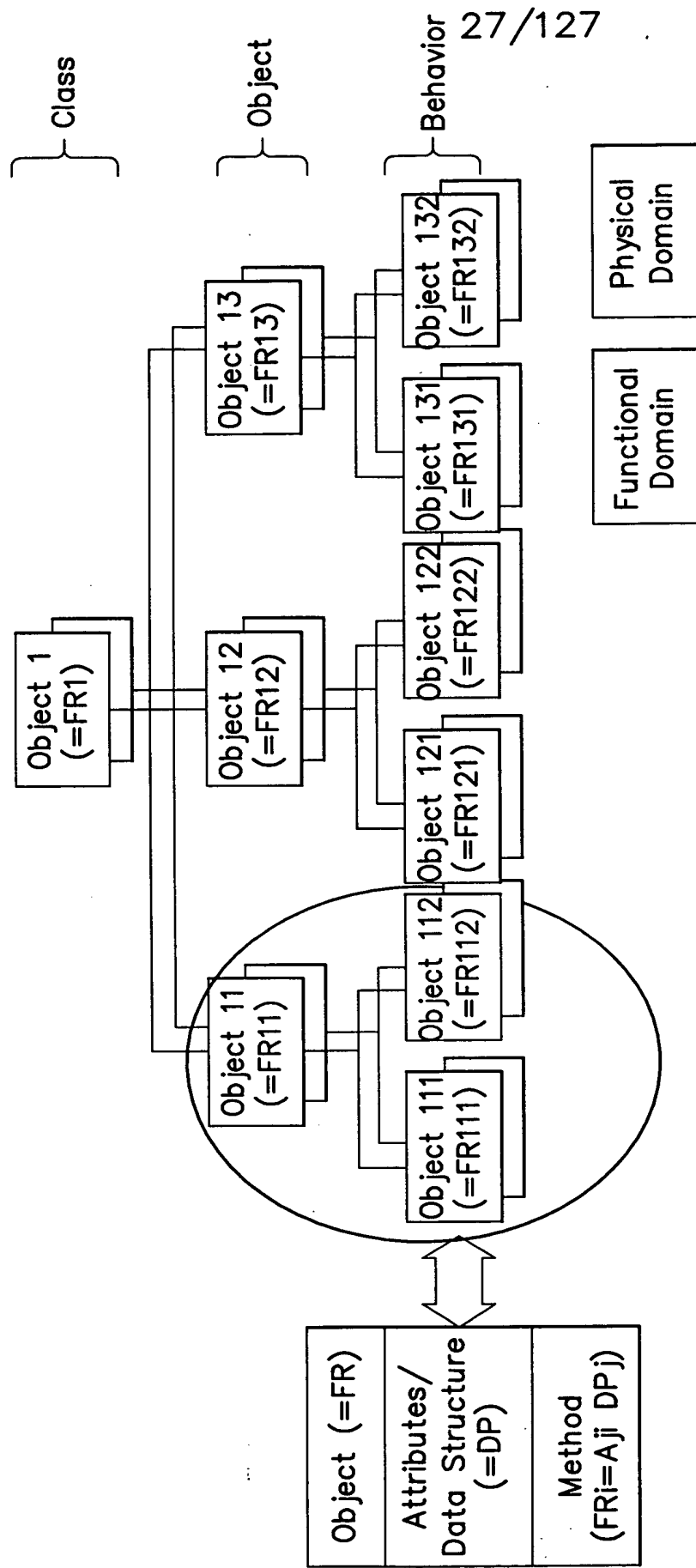
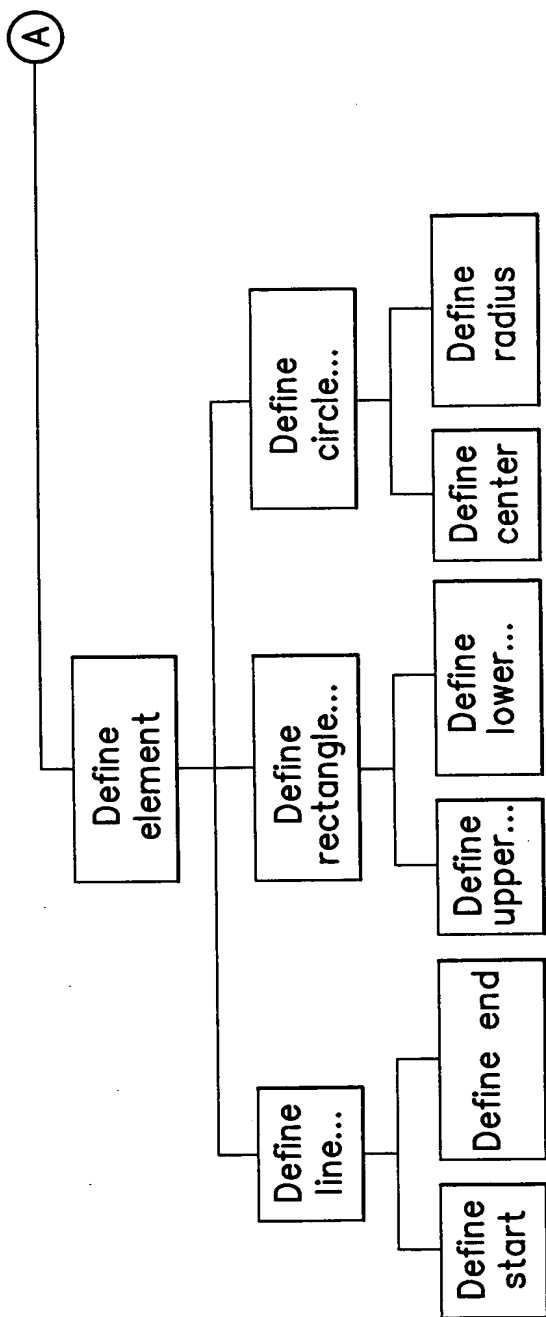


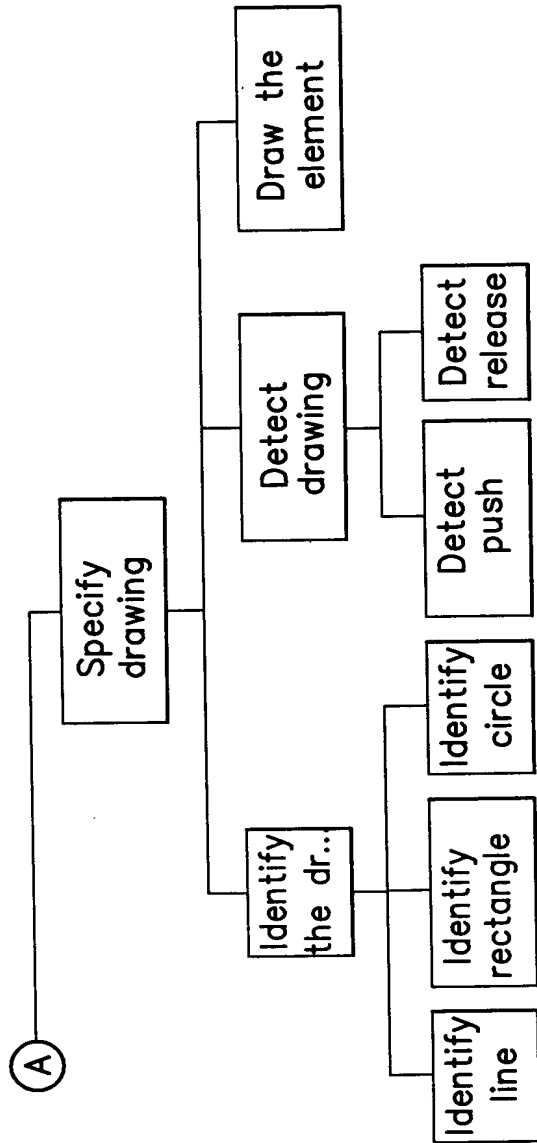
FIG. 27



(a) Functional Domain

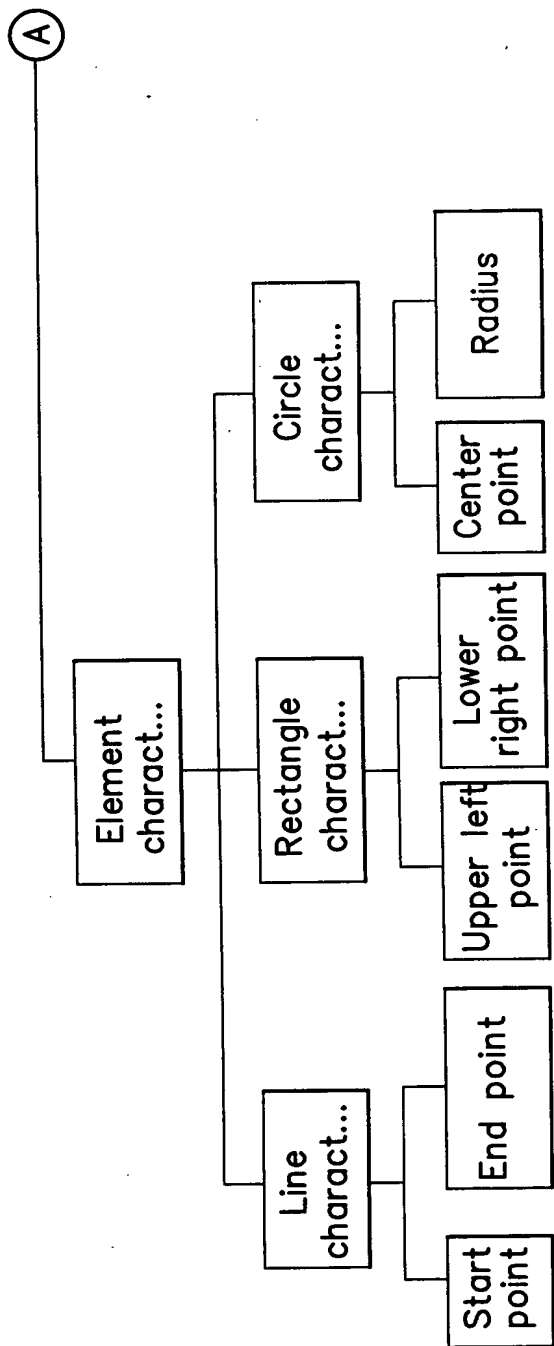
FIG. 28A(1) FIG. 28A(2)

FIG. 28A(1)



(a) Functional Domain

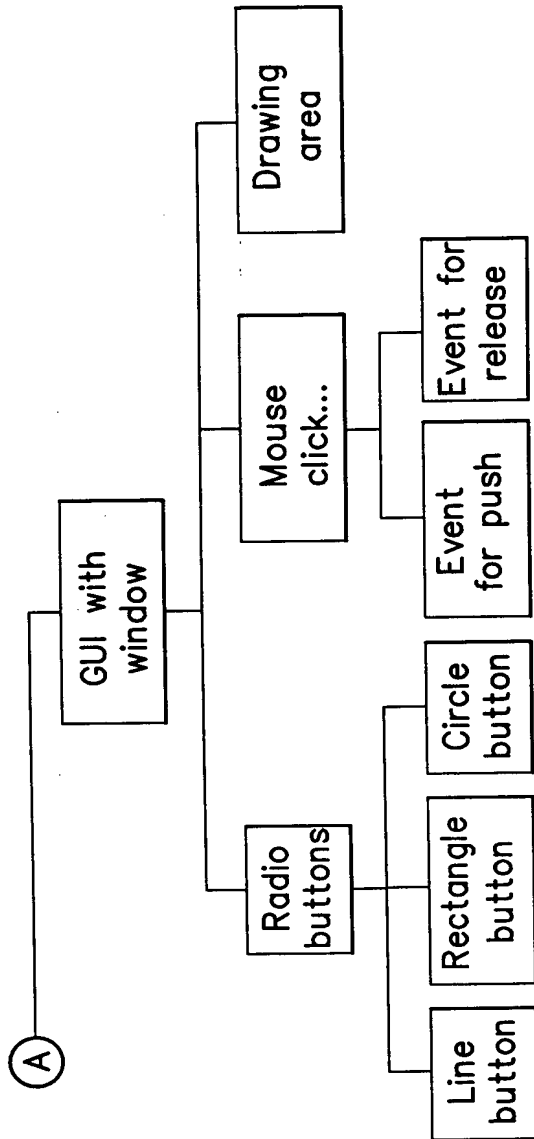
FIG. 28A(2)



(b) Physical Domain

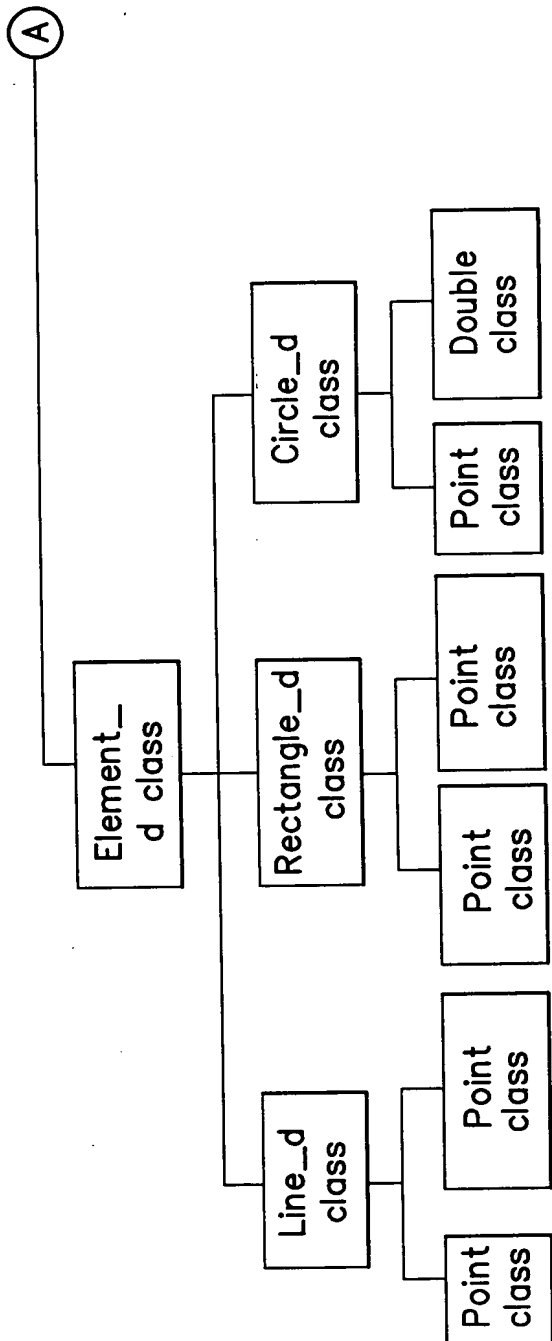
FIG. 28B(1) FIG. 28B(2)

FIG. 28B(1)



(b) Physical Domain

FIG. 28B(2)

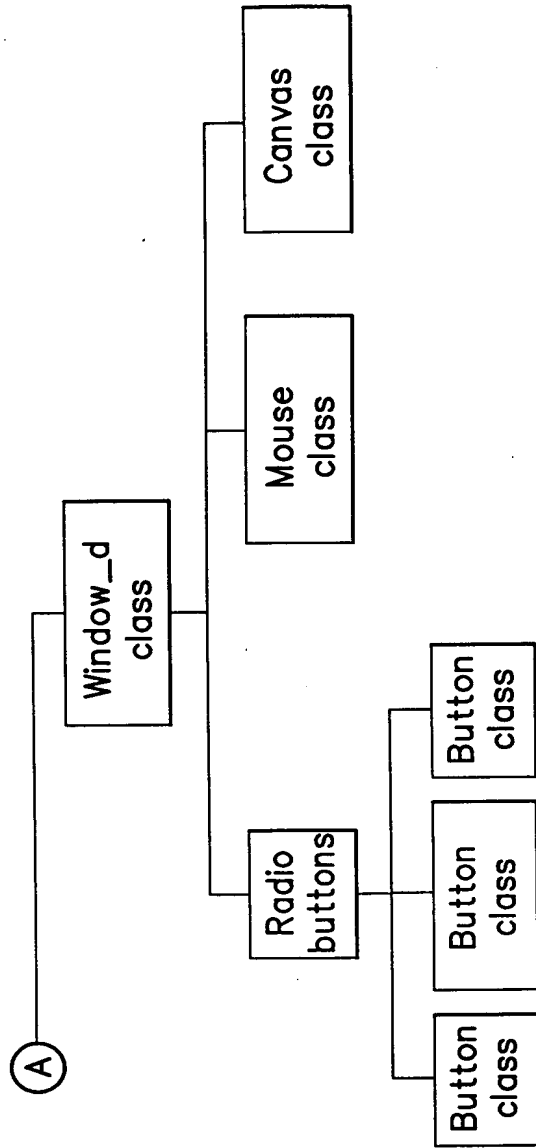


(c) Process Domain

FIG. 28C(1) FIG. 28C(2)

FIG. 28C(1)





(c) Process Domain

FIG. 28C(2)

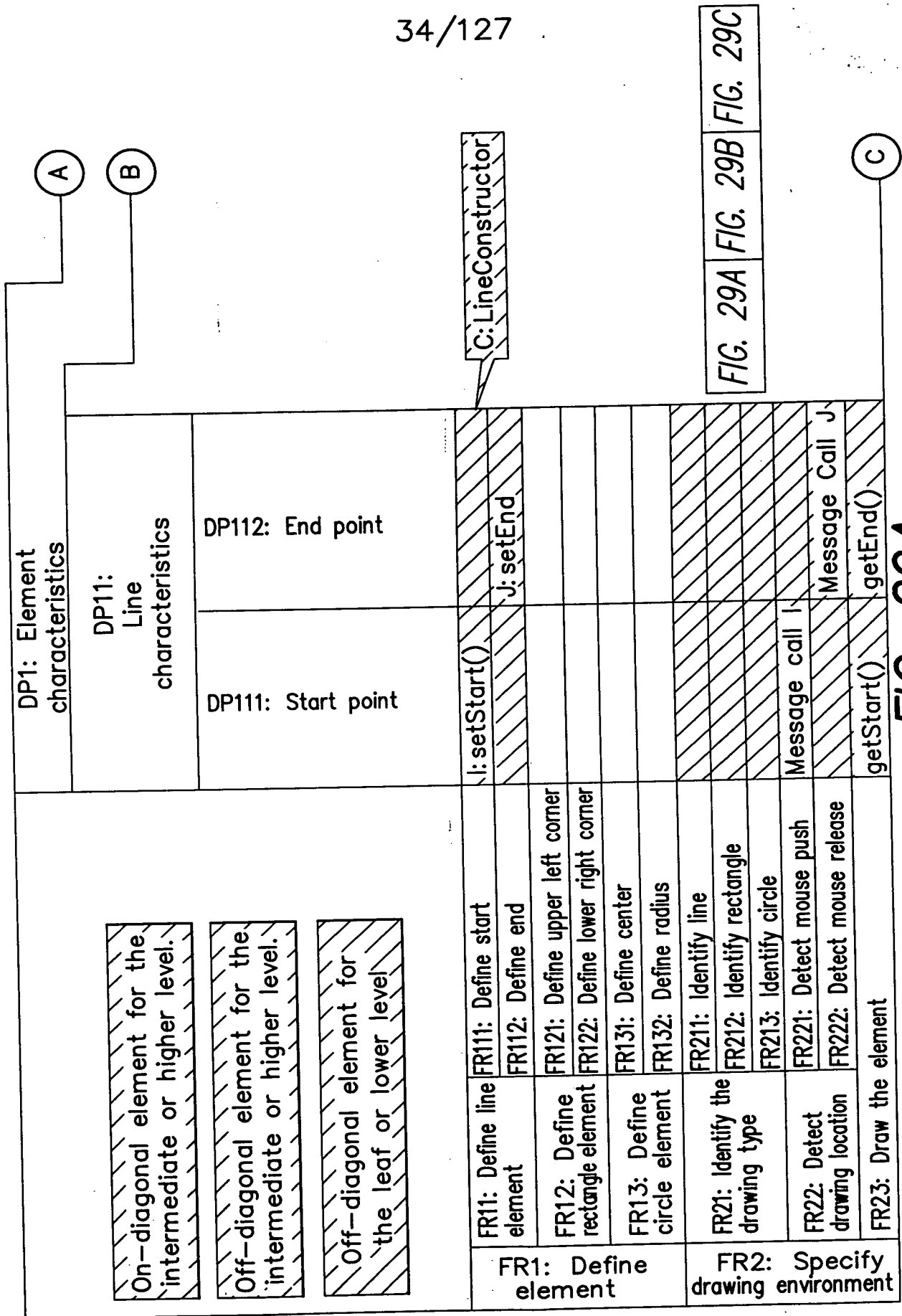


FIG. 29A

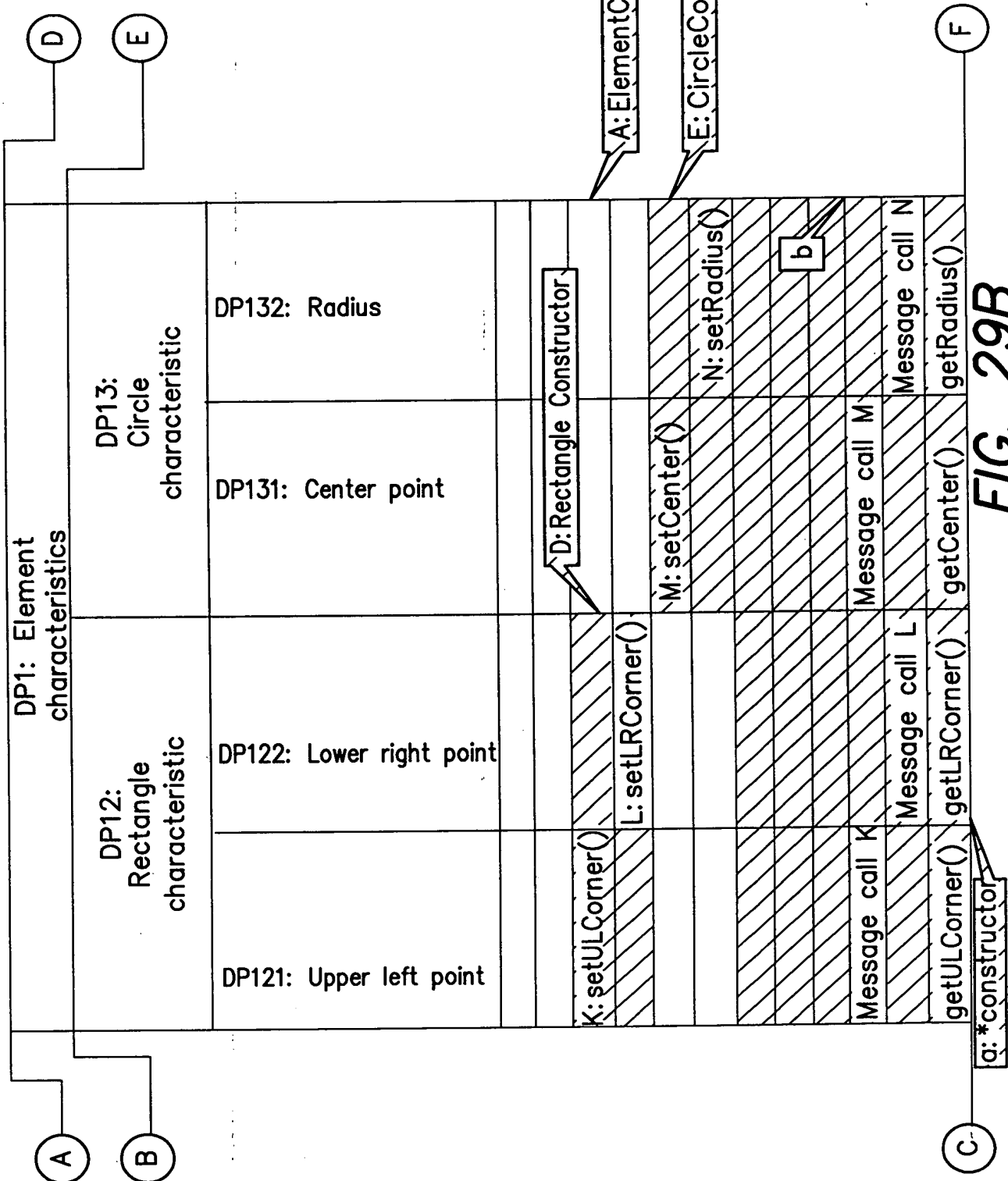


FIG. 29B

TOP SECRET

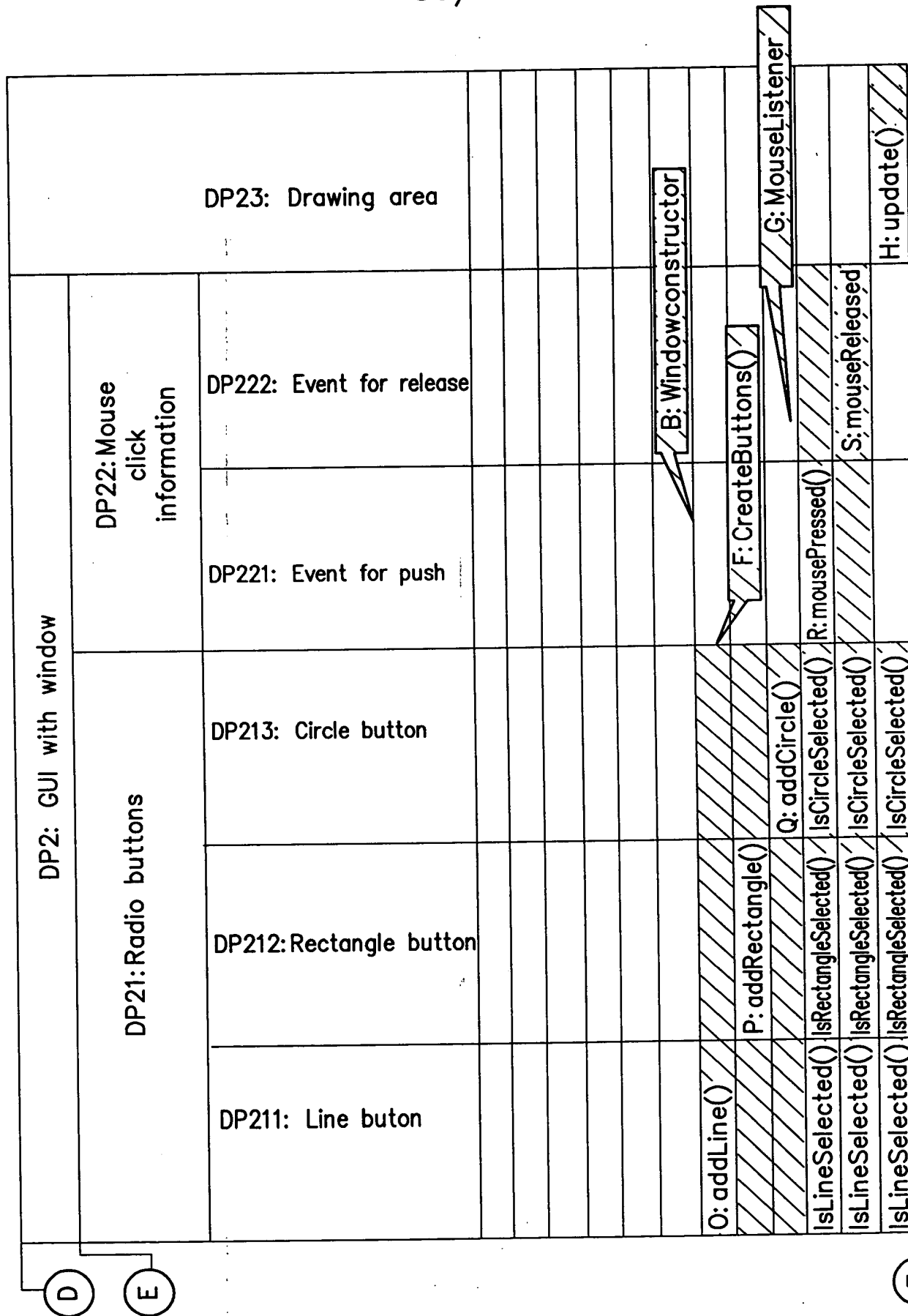


FIG. 29C

Object	Object 111/11 2/121/1 22/131	Object 132	Object 11		Object 12		Object 13	
			Line_d		Rectangle_d		Circle_d	
Name	Point	Double	DP111	Point start	DP121	Point upper_left	DP131	Point center
			DP112	Point end	DP122	Point lower_right	DP132	Double radius
Attribute								
Method			C	Line()	D	Rectangle()	E	Center()
			I	setStart()	K	setULCorner()	M	setCenter()
			J	setEnd()	L	setLLCorner()	N	setRadius()

FIG. 30A

FIG. 30A

Object 1	Object 2	Object 211/212/213	Object 22	Object 23	Object 1*
Element_d	Window_d	RadioBu	Mouse	Canvas	Element_*
DP11 Line l	DP211 Radiobutton line				
DP12 Rectangle r	DP212 Radiobutton rectangle				
DP13 Circle c	DP213 Radiobutton circle				
	DP22 Mouse m				
	DP23 Canvas c				
A Element()	B Window()			a	Element*()
	F CreateButtons()				getStart()
	O addLine()				getEnd()
	P addRectangle				getULCorner()
	Q addCircle()				getLRCorner()
	G implement MouseListener				getCenter()
	R mousePressed()				getRadius()
	S mouseReleased()				assignLine()
	H draw()				assignRectangle()
	b/c isLineSelected()				assignCircle()
	b/c isRectangleSelected()				
	b/c isCircleSelected()				

FIG. 30B

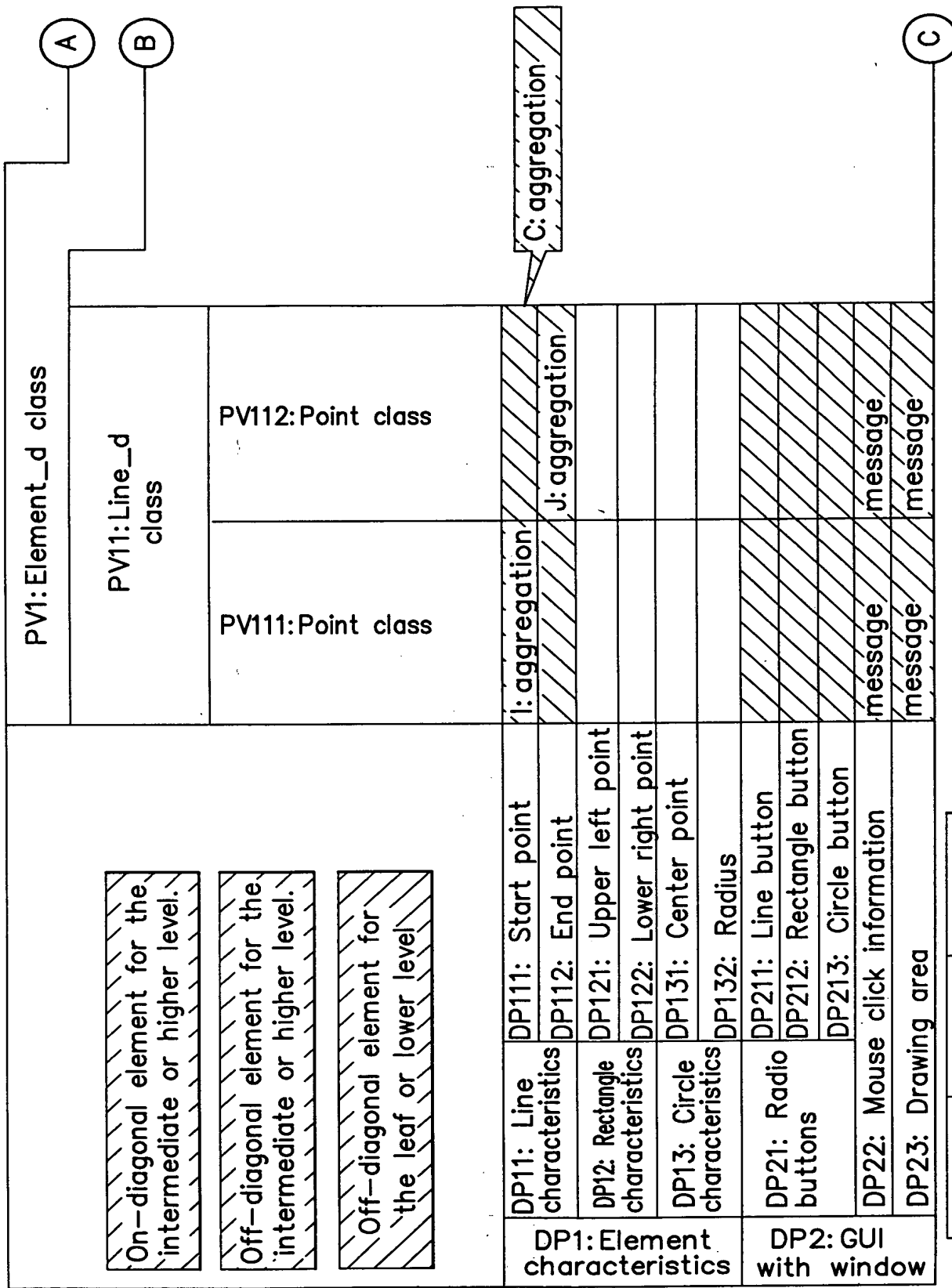


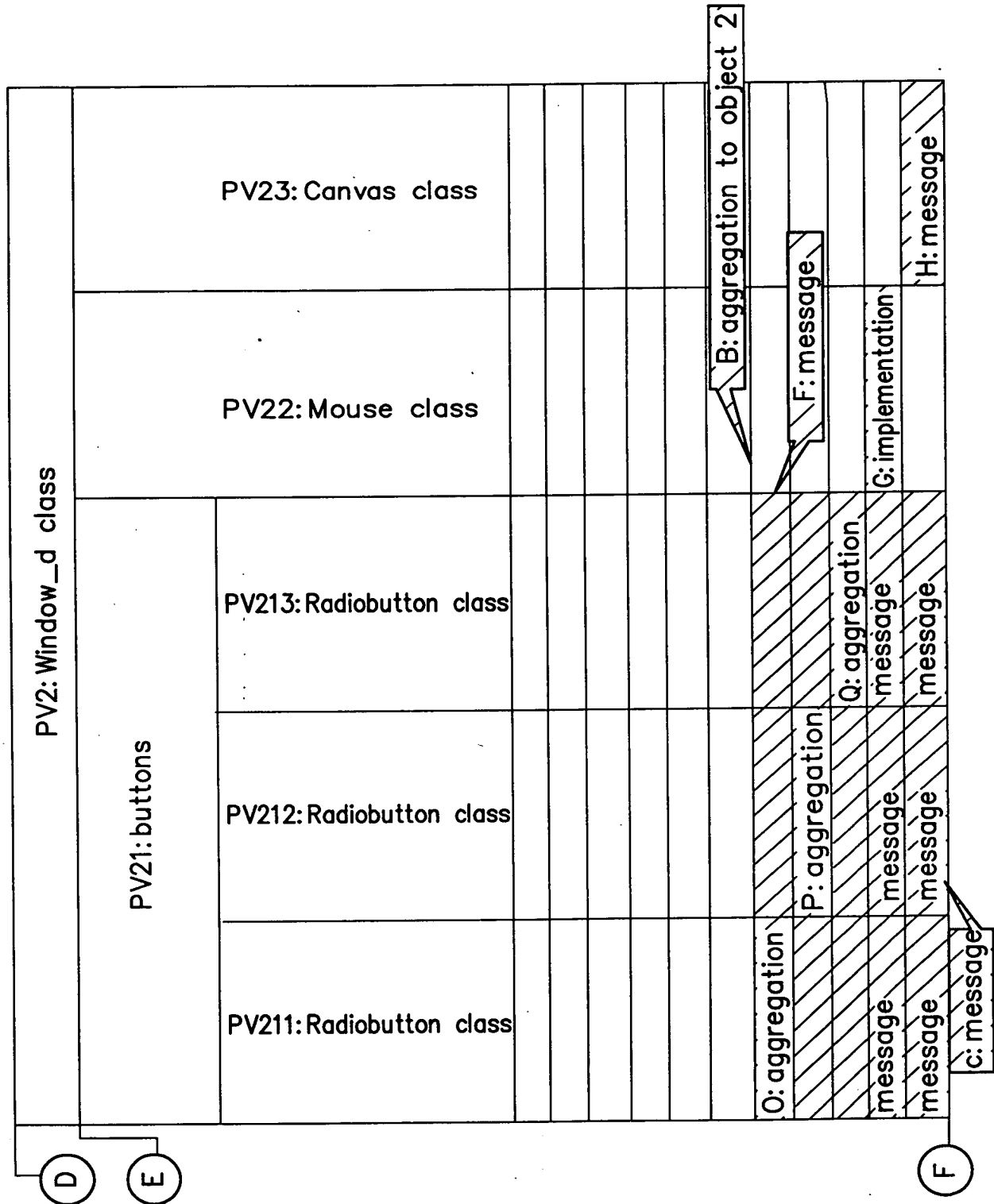
FIG. 31A

FIG. 31B

FIG. 31C







**FIG. 31C**

T09T40-B29TE260

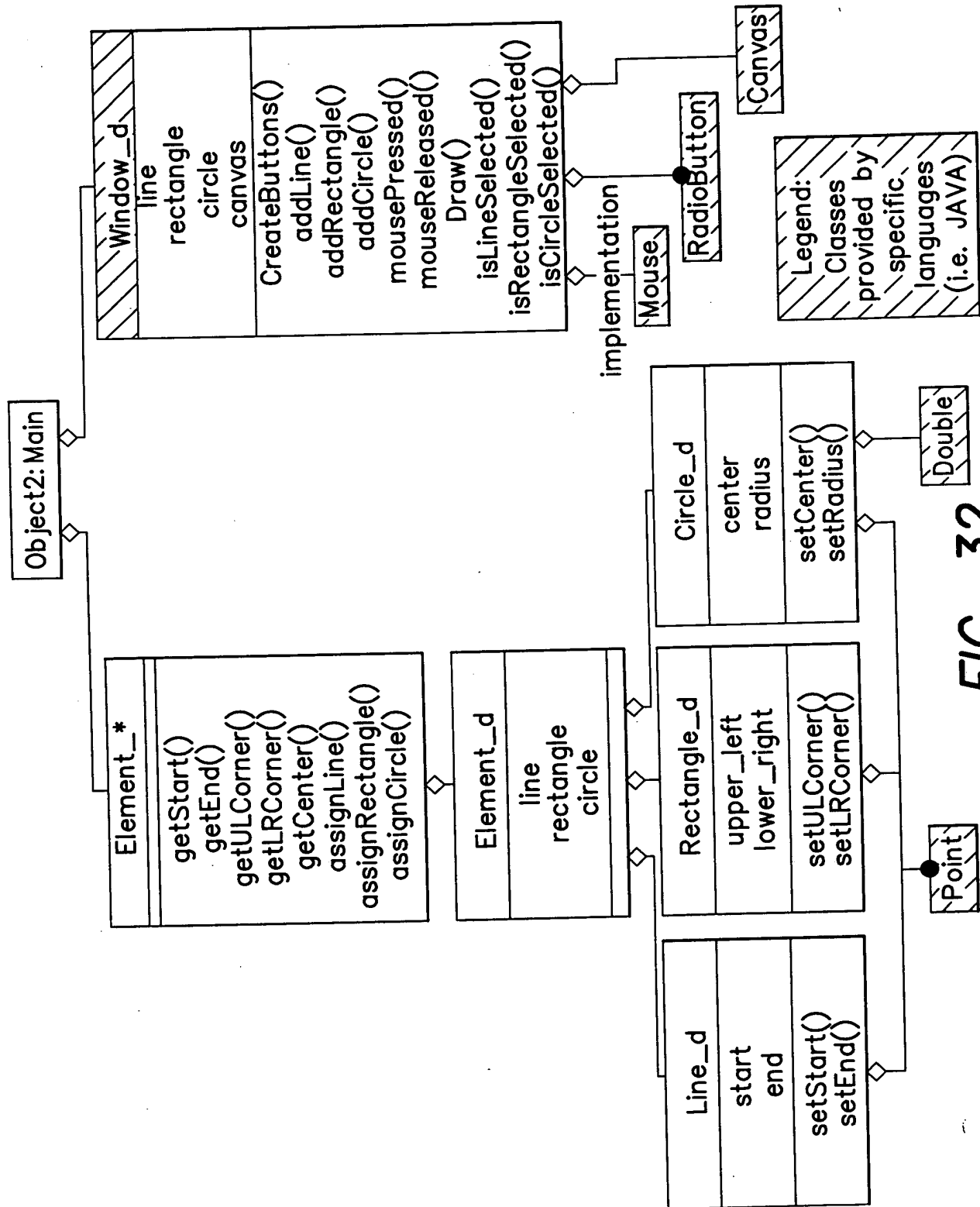


FIG. 32

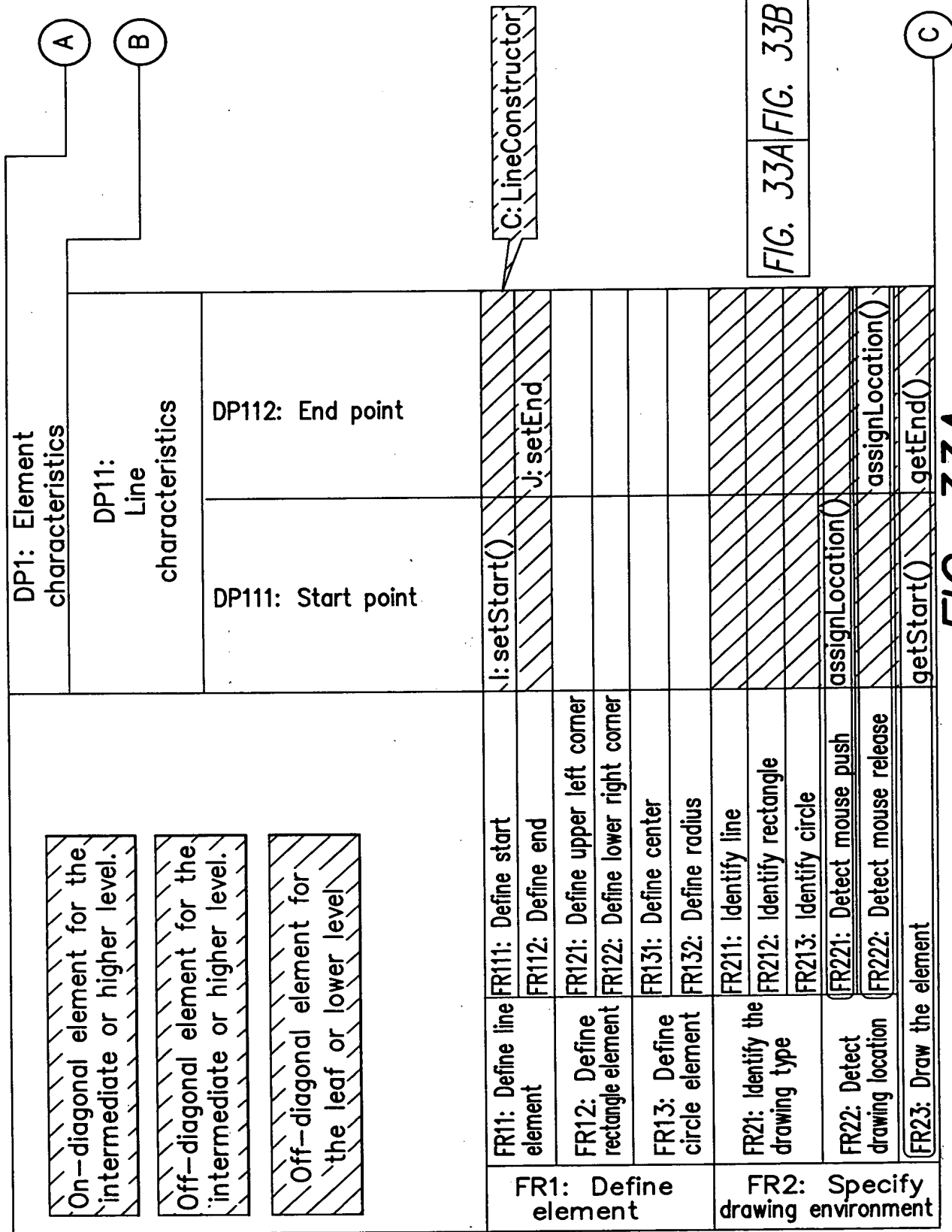


FIG. 33A

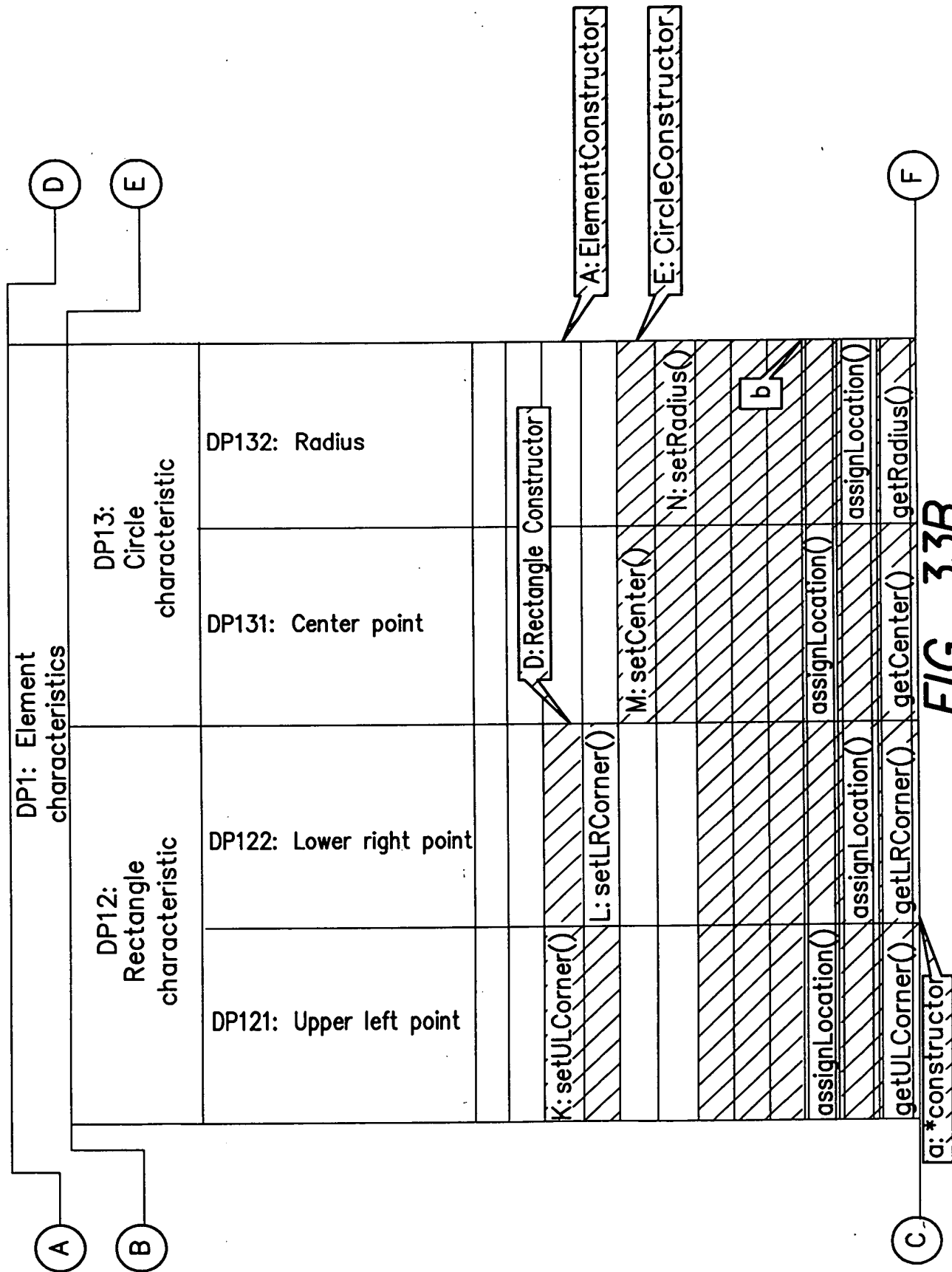
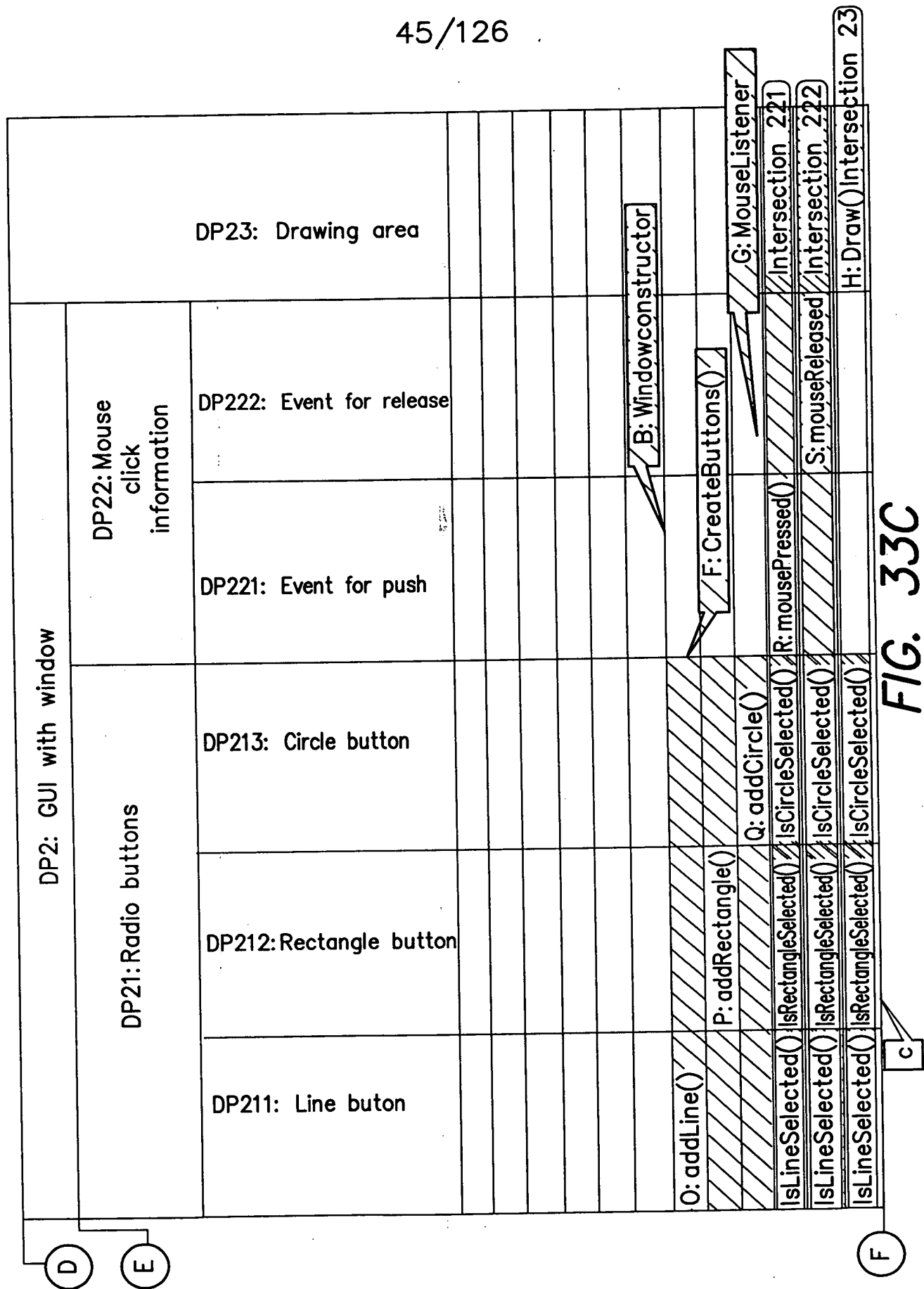


FIG. 33B



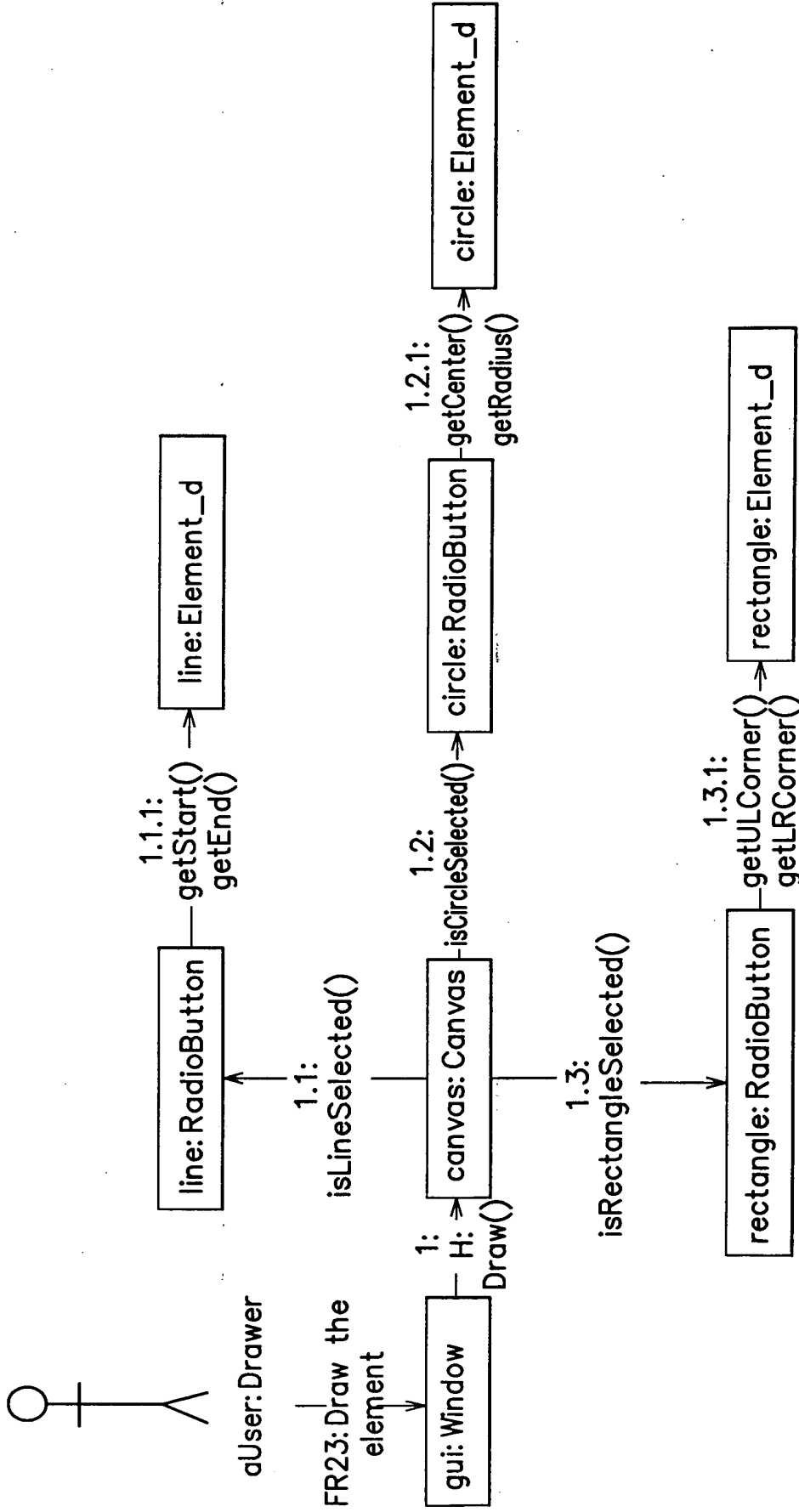


FIG. 34

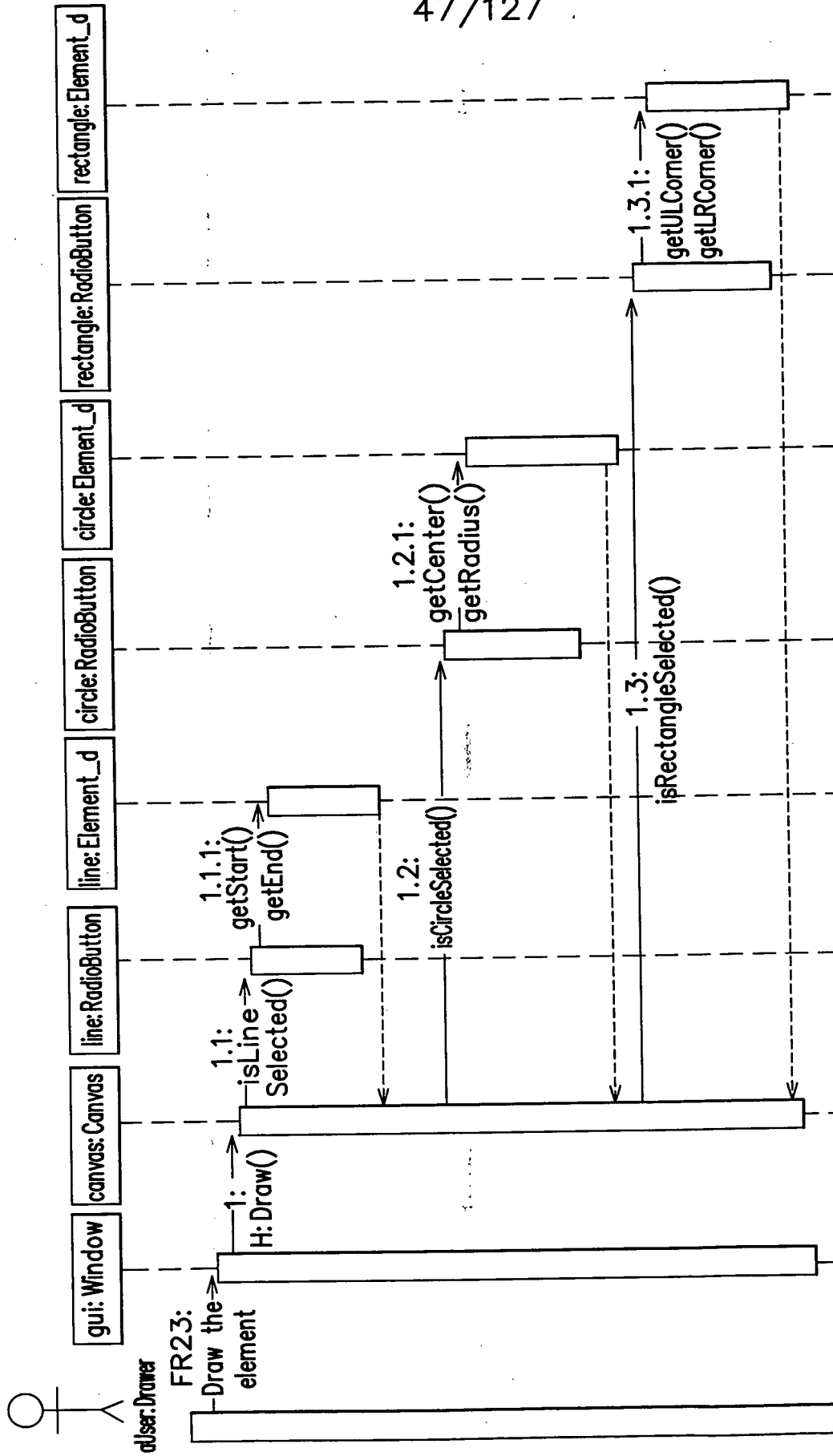


FIG. 35

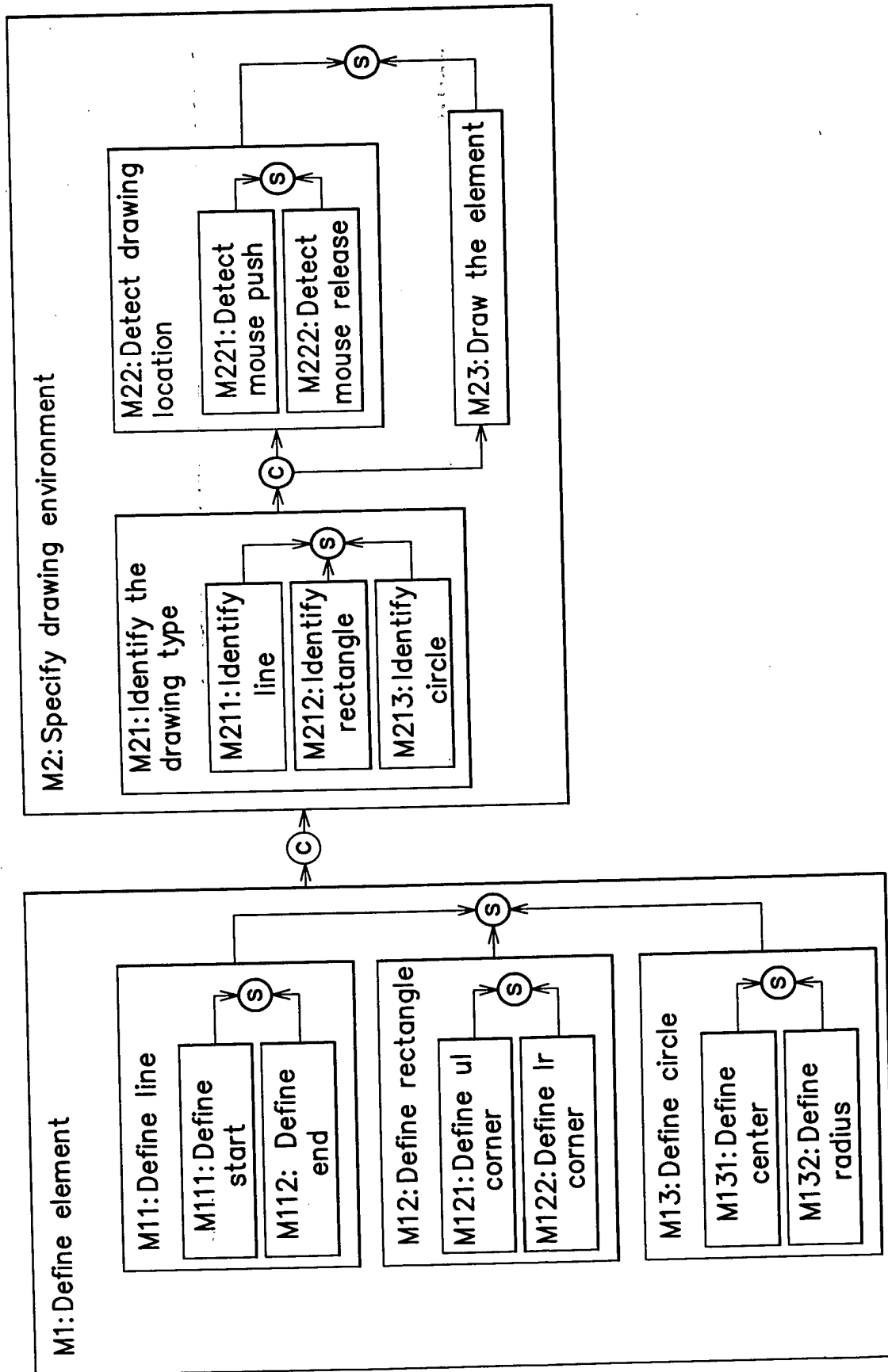


FIG. 36



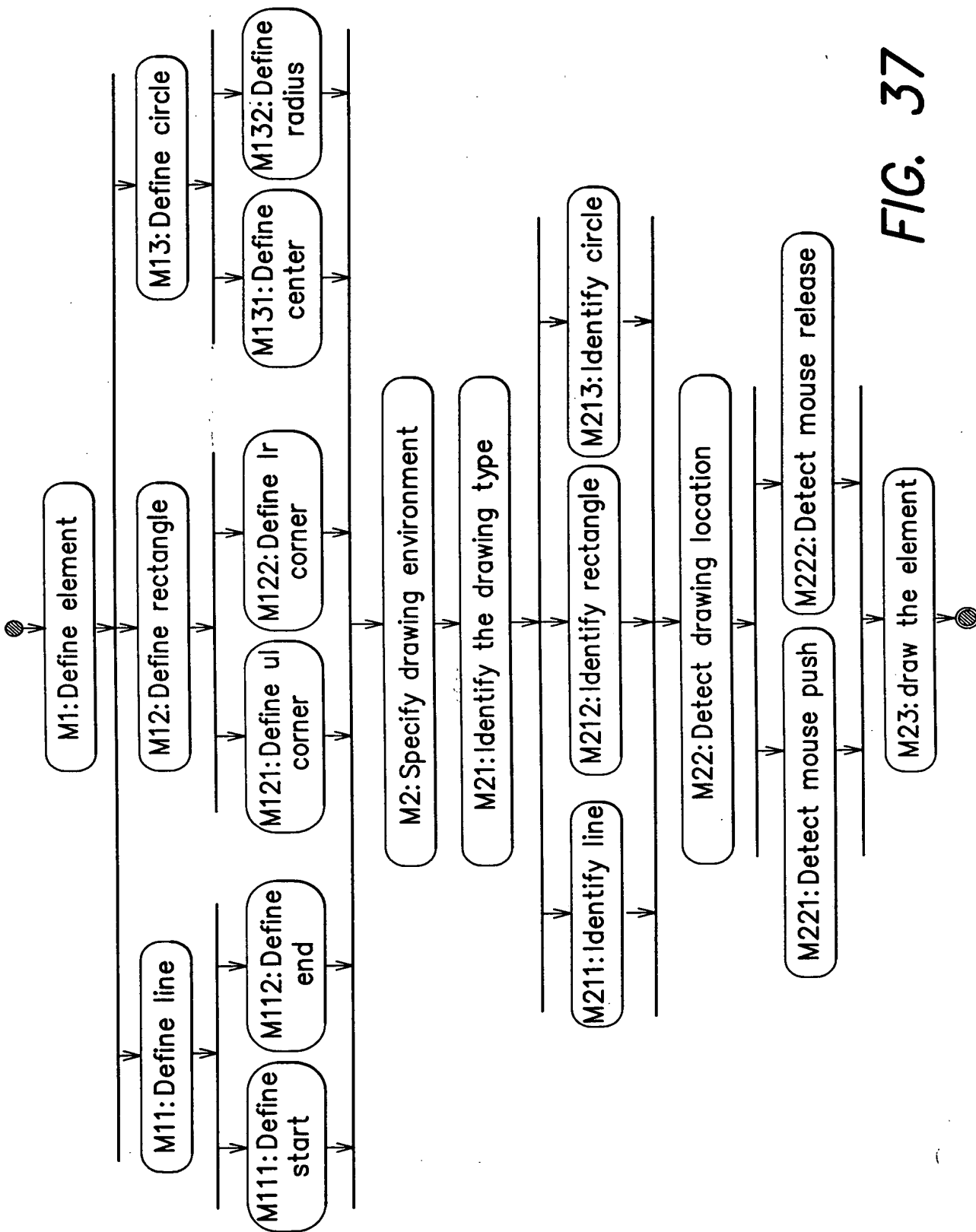


FIG. 37

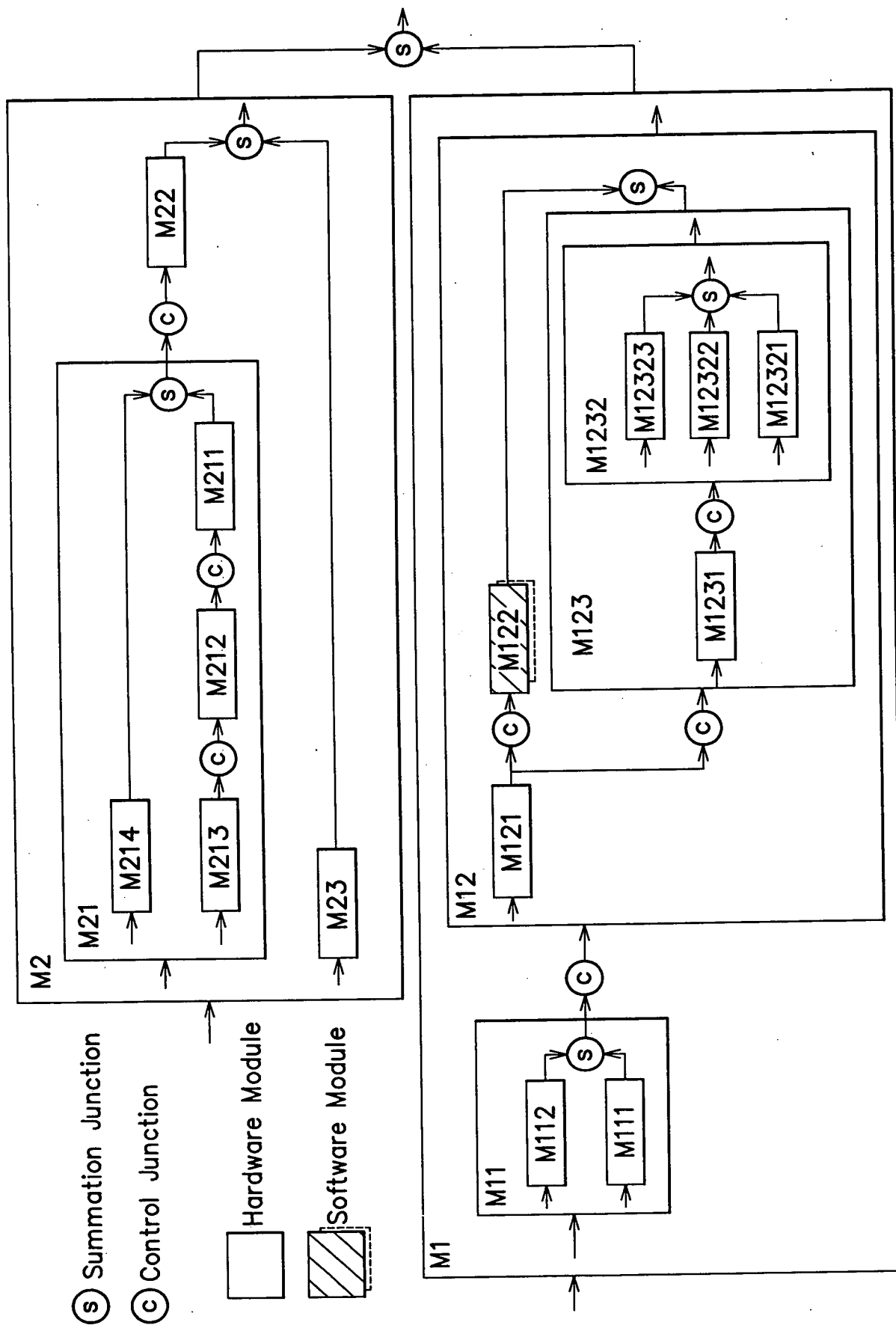


FIG. 38

(object Petal	
version 40)	
(object Design	"Logical View"
is_unit	TRUE
is_loaded	TRUE
file_name	"SDATA\\demo1.mdl"
quid	"3353F13A0384"
defaults	(object defaults
	rightMargin
	leftMargin
	topMargin
	bottomMargin
	pageOverlap
	clipIconLabels
	autoResize
	snap ToGrid
	gridX
	gridY
	defaultFont
	size
	face
	bold
	italics
	underline
	strike
	color
	default_color

0.250000	
0.250000	
0.250000	
0.500000	
0.250000	
TRUE	
TRUE	
TRUE	
16	
16	
(object Font	
9	
"helvetica"	
FALSE	
FALSE	
FALSE	
FALSE	
0	
TRUE)	

FIG. 39A
FIG. 39B

A

B

FIG. 39A

B

```

showMessageNum 1
showClassOfObject TRUE
notation "Unified"
root_usecase_package (object Class_category"UseCaseView"
quid "3353F13A0386"
exportControl "Public"
global TRUE
logical_models (list unit_reference_list
(objectClass"Student"
quid "3353F162000A"
documentation "Someone who is registered to take classes at the University"
stereotype "Actor")

```

A

FIG. 39B

T09T4D-B29TE260

Code	Parent	Number	Description	Keyword	Comment	Category	Verification	Leaf
EX-a	0	1	Define element	—	—	—	—	FALSE
EX-a	0	2	Specify drawing environment	—	—	—	—	FALSE
EX-a	1	1	Define line element	—	—	—	—	FALSE
EX-a	1	2	Define rectangle element	—	—	—	—	FALSE
EX-a	1	3	Define circle element	—	—	—	—	FALSE
EX-a	1.1	1	Define start	—	—	—	—	TRUE
EX-a	1.1	2	Define end	—	—	—	—	TRUE
EX-a	1.2	1	Define upper left corner	—	—	—	—	TRUE
EX-a	1.2	2	Define lower right corner	—	—	—	—	TRUE
EX-a	1.3	1	Define center	—	—	—	—	TRUE
EX-a	1.3	2	Define radius	—	—	—	—	TRUE
EX-a	2	1	Identify the drawing type	—	—	—	—	FALSE
EX-a	2	2	Detect drawing location	—	—	—	—	FALSE
EX-a	2	3	Draw the element	—	—	—	—	TRUE
EX-a	2.1	1	Identify line	—	—	—	—	TRUE
EX-a	2.1	2	Identify rectangle	—	—	—	—	TRUE
EX-a	2.1	3	Identify circle	—	—	—	—	TRUE
EX-a	2.2	1	Detect mouse push	—	—	—	—	TRUE
EX-a	2.2	2	Detect mouse release	—	—	—	—	TRUE

FIG. 40

Code	Parent	Number	Alternative	Description	Keyword	Comment	Category	Verification	Leaf
EX-a	0	1	0	Element characteristics	—	—	—	—	FALSE
EX-a	0	2	0	GUI with window	—	—	—	—	FALSE
EX-a	1	1	0	Line characteristics	—	—	—	—	FALSE
EX-a	1	2	0	Rectangle characteristics	—	—	—	—	FALSE
EX-a	1	3	0	Circle characteristics	—	—	—	—	FALSE
EX-a	1.1	1	0	Start point	—	—	—	—	TRUE
EX-a	1.1	2	0	End point	—	—	—	—	TRUE
EX-a	1.2	1	0	Upper left point	—	—	—	—	TRUE
EX-a	1.2	2	0	Lower right point	—	—	—	—	TRUE
EX-a	1.3	1	0	Center point	—	—	—	—	TRUE
EX-a	1.3	2	0	Radius	—	—	—	—	TRUE
EX-a	2	1	0	Radio buttons	—	—	—	—	FALSE
EX-a	2	2	0	Mouse click information	—	—	—	—	FALSE
EX-a	2	3	0	Drawing area	—	—	—	—	TRUE
EX-a	2.1	1	0	Line button	—	—	—	—	TRUE
EX-a	2.1	2	0	Rectangle button	—	—	—	—	TRUE
EX-a	2.1	3	0	Circle button	—	—	—	—	TRUE
EX-a	2.2	1	0	Event for push	—	—	—	—	TRUE
EX-a	2.2	2	0	Event for release	—	—	—	—	TRUE
DP Table									

FIG. 41A

FIG. 41B

FIG. 41A

FIG. 41A

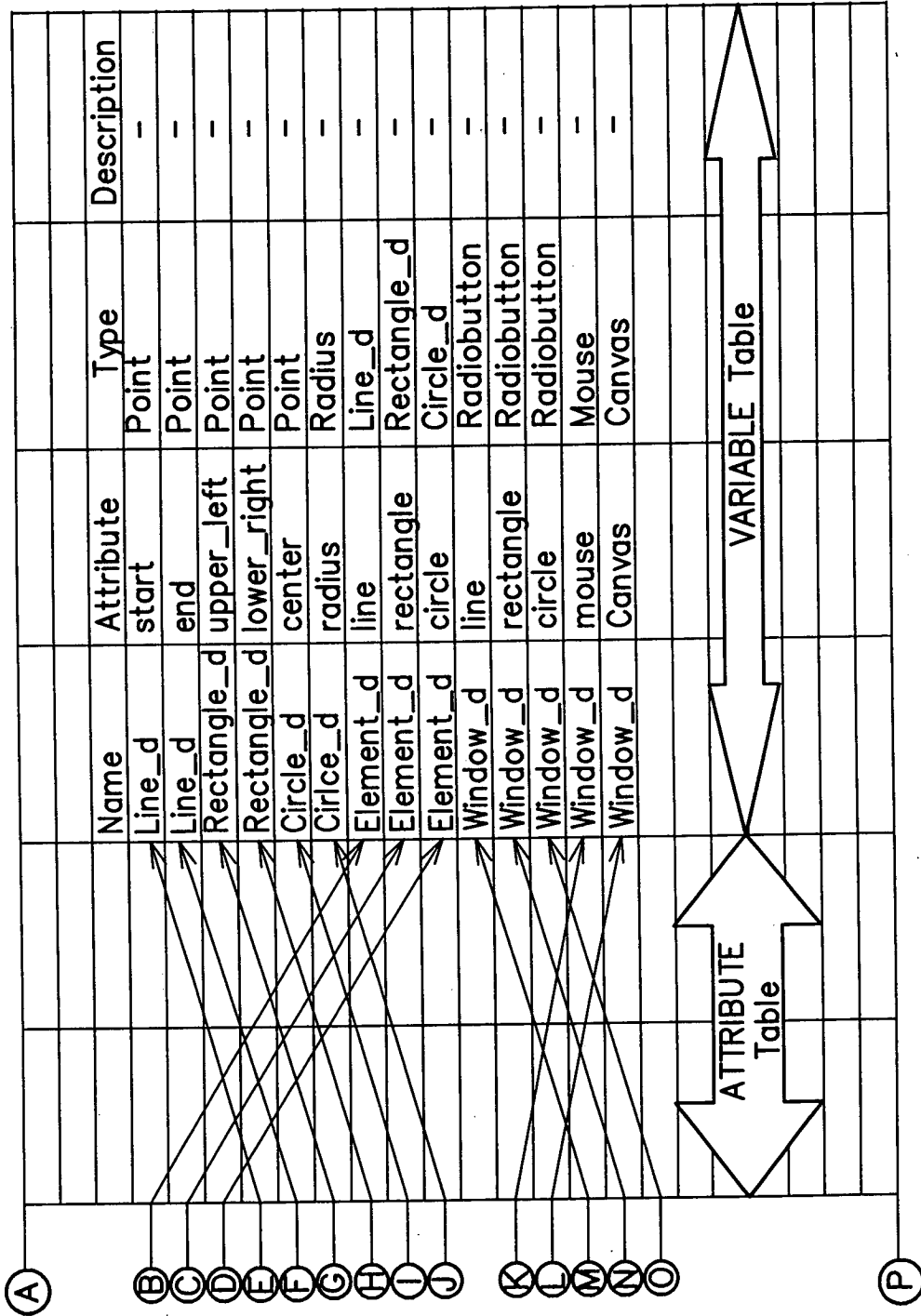


FIG. 41B

Code1	Code2	Value	Comment	Name	Method	Type	Description
Ex-a.0.1	Ex-a.0.1.0	A	-	Line_d	Line_d()	Line_d	-
Ex-a.0.2	Ex-a.0.1.0	a	-	Line_d	setStart()	void	-
Ex-a.0.2	Ex-a.0.2.0	B	-	Line_d	setEnd()	void	-
Ex-a.1.1	Ex-a.1.1.0	C	-	Rectangle_d	Rectangle_d()	Rectangle_d	-
Ex-a.1.2	Ex-a.1.2.0	D	-	Rectangle_d	setULCorner()	void	-
Ex-a.1.3	Ex-a.1.3.0	E	-	Rectangle_d	setLRCorner()	void	-
Ex-a.2.1	Ex-a.2.1.0	F	-	Circle_d	Circle_d()	Circle_d	-
Ex-a.2.2	Ex-a.2.1.0	b	-	Circle_d	setCenter()	void	-
Ex-a.2.2	Ex-a.2.2.0	G	-	Circle_d	setRadius()	void	-
Ex-a.2.3	Ex-a.2.1.0	c	-	Element_d	Element_d()	Element_d	-
Ex-a.2.3	Ex-a.2.3.0	H	-	Window_d	Window_d()	Window_d	-
Ex-a.1.1.1	Ex-a.1.1.1.0	I	-	Window_d	CreateButtons()	void	-
Ex-a.1.1.2	Ex-a.1.1.2.0	J	-	Window_d	addLine()	void	-
Ex-a.1.2.1	Ex-a.1.2.1.0	K	-	Window_d	addRectangle()	void	-
Ex-a.1.2.2	Ex-a.1.2.2.0	L	-	Window_d	addCircle()	void	-
Ex-a.1.3.1	Ex-a.1.3.1.0	M	-	Window_d	MouseListener()	void	-
Ex-a.1.3.2	Ex-a.1.3.2.0	N	-	Window_d	mousePressed()	Point	-
Ex-a.2.1.1	Ex-a.2.1.1.0	O	-	Window_d	mouseReleased()	Point	-
Ex-a.2.1.2	Ex-a.2.1.2.0	P	-	Window_d	draw()	void	-
Ex-a.2.1.3	Ex-a.2.1.3.0	Q	-	Window_d	isLineSelected()	boolean	-
Ex-a.2.2.1	Ex-a.2.2.1.0	R	-	Window_d	isRectangleSelected()	boolean	-
Ex-a.2.2.2	Ex-a.2.2.2.0	S	-	Window_d	isCircleSelected()	boolean	-

FIG. 42A  
FIG. 42B

(A)

(B)

(C)

FIG. 42A



(A)	Ex-a.2.3	Ex-a.1.1.1.0	x	-	Element_*	Element_*	Element_*	-
	Ex-a.2.3	Ex-a.1.1.2.0	x	-	Element_*	getStart()	void	-
	Ex-a.2.3	Ex-a.1.2.1.0	x	-	Element_*	getEnd()	void	-
	Ex-a.2.3	Ex-a.1.2.2.0	x	-	Element_*	getULCorner()	void	-
	Ex-a.2.3	Ex-a.1.3.1.0	x	-	Element_*	getLRCorner()	void	-
	Ex-a.2.3	Ex-a.1.3.2.0	x	-	Element_*	getCenter()	void	-
	Ex-a.2.2	Ex-a.1.1.0	x	-	Element_*	getRadius()	void	-
	Ex-a.2.2	Ex-a.1.2.0	x	-	Element_*	assignLine()	void	-
	Ex-a.2.2	Ex-a.1.3.0	x	-	Element_*	assignRectangle()	void	-
					Element_*	assignCircle()	void	-

```

/*
Comments for class:
  File Name
  FR description
  DP description
  ...
*/

```

Introduction

Reference for import or include

Define import package

Package PackageName

ClassType ClassName {

Define class

```

/*
Comments for attributes
  FR description
  DP description
  ...
*/

```

AttributeType AttributeName:

define global attributes

AttributeType AttributeName:

AttributeType AttributeName:

A

FIG. 43A

FIG. 43B

B

FIG. 43A

```
/* source code end*/
```

## Define finish

**FIG. 43B**

[illegible]

```

/*
Comments for class:
  File Name
  FR description
  DP description
  ...

```

```

*/

```

```

/*
Coments for class:
File Name: Window_d.java
FR2: Specify drawing environment
DP2: GUI with window
FR2=a*DP1(Element
characteristic)+B*DP2(GUI
with window)

```

```

*/

```

Reference for import or include

```

import javax.swing.*;
import java.awt.*;

```

```

Package PackageName
ClassType ClassName {

```

```

public class window_d { /*DP2*/

```

```

/*
Comments for attributes
  FR description
  DP description
  ...

```

```

*/

```

```

AttributeType AttributeName;

```

```

AttributeType AttributeName;

```

```

AttributeType AttributeName;

```

```

/* Comments for attributes:
FR211: Identify line
DP211: Line button */
Radiobutton line; /*DP211*/

```

```

/* Comments for attributes:
FR212: Identify rectangle
DP212: Rectangle button */
Radiobutton rectangle; /*DP212*/
...

```

A

FIG. 44A

FIG. 44B

FIG. 44C

B

FIG. 44A

105740-B23FE250

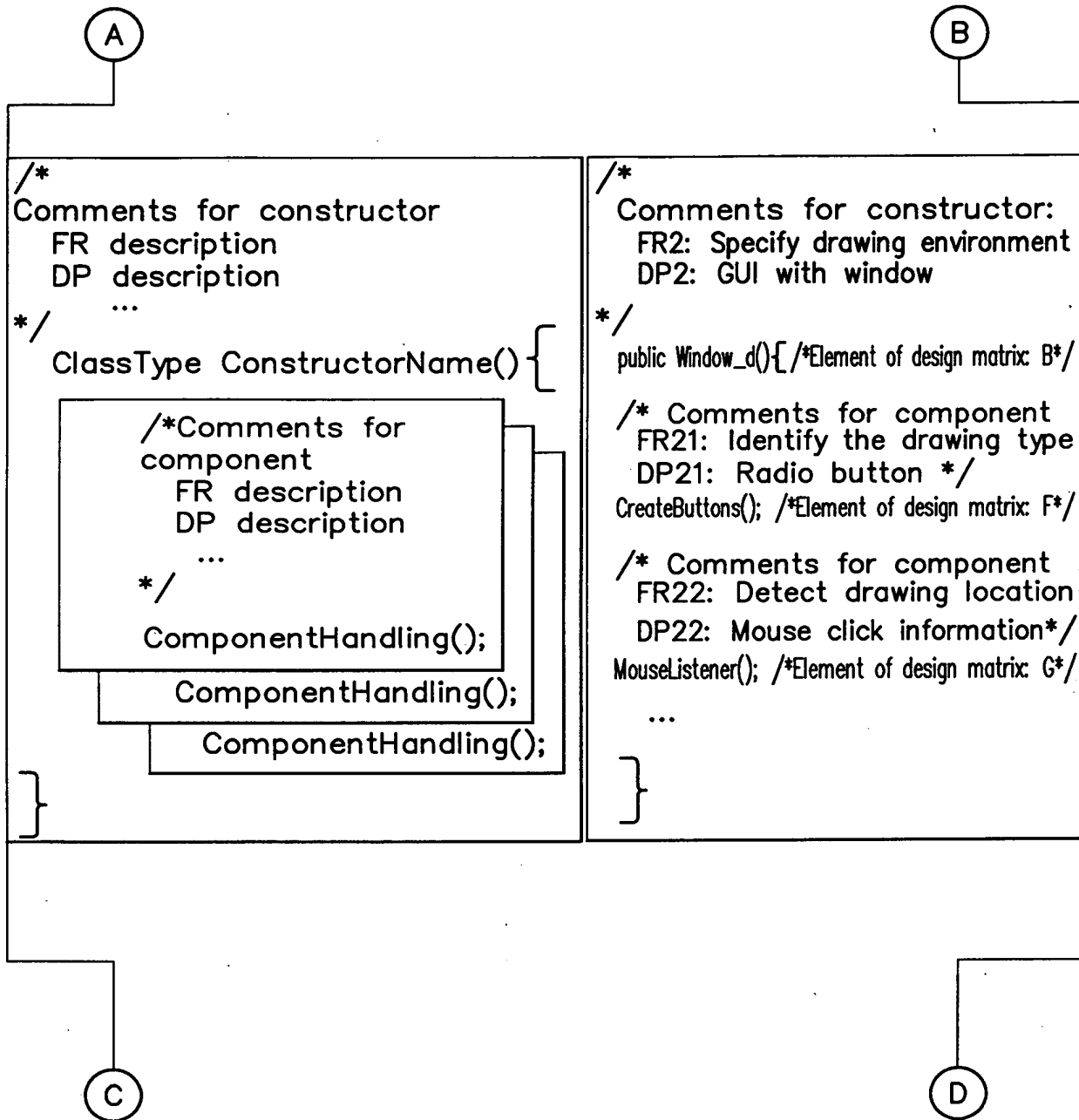


FIG. 44B

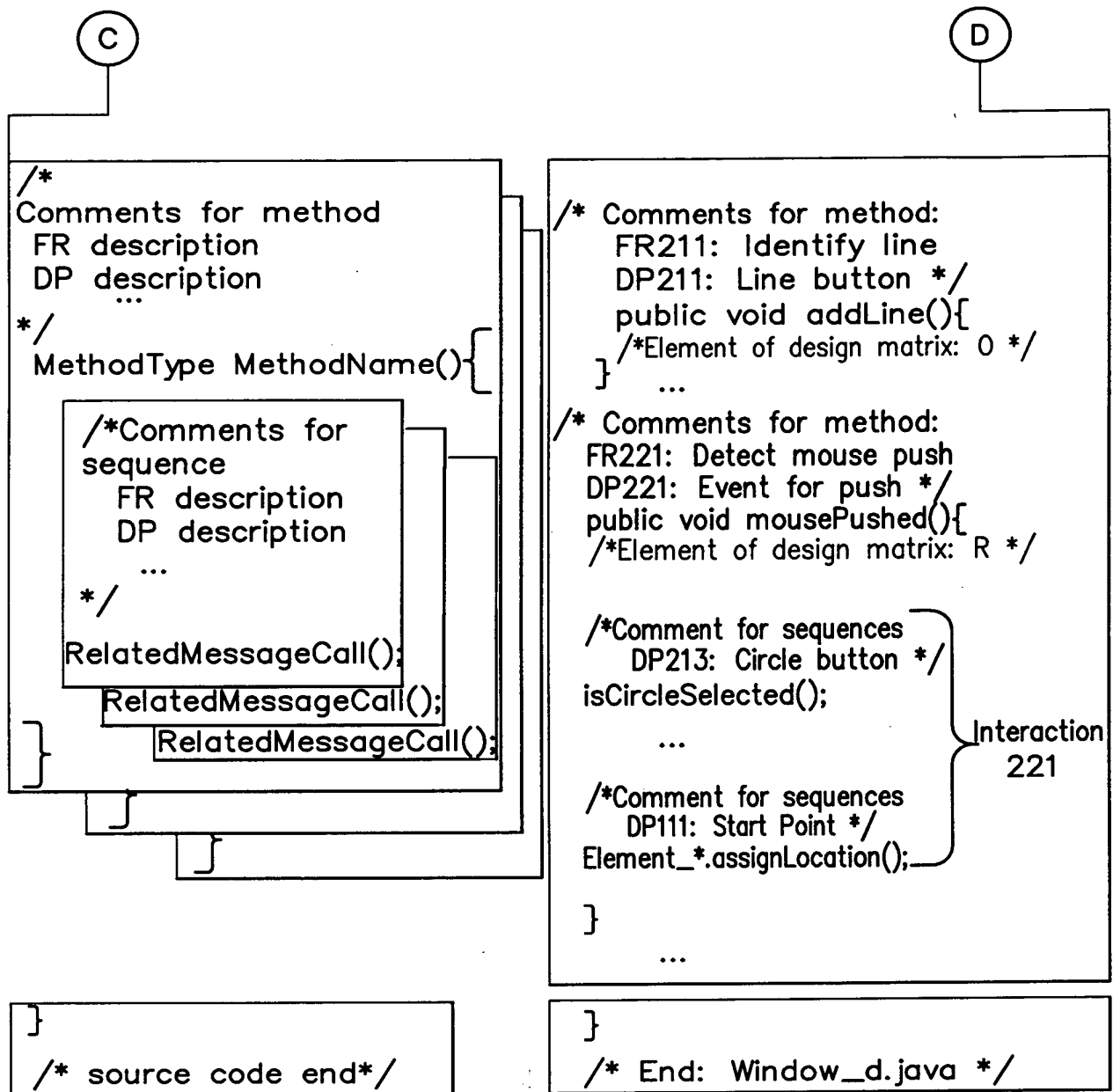


FIG. 44C

FR Information:		DP Information:	
Number	Description	Num...	Description
FR#.1	Provide security	DP#.1	Login privilege
FR#.2	Assign tasks	DP#.2	Resource of desig...
FR#.3	Manage schedule	DP#.3	Schedule-manage...
FR#.4	Construct design h...	DP#.4	Data structure for...
FR#.5	Facilitate changes...	DP#.5	ECO handling tool

FIG. 45A

	FR	DP
1	FR 1 description	DP 1 description
2	FR 2 description	DP 2 description
3	FR 3 description	DP 3 description

FIG. 45B

FR Information:		DP Information:	
Number	Description	Number	Description
FR#.1	Control the water fl...	DP#.1	Angle for flow ra...
FR#.2	Control the temper...	DP#.1(1)	Angle of hot wat...
		DP#.2	Angle for tempe...
		DP#.2(1)	Connecting rod...
		DP#.2(2)	Angle of cold w...

*FIG. 46A*

	FR	DP
1	FR 1 description	DP 1 description
2	FR 2 description {	Alternative DP 2(a)
		Alternative DP 2(b)
		Alternative DP 2(c)
3	FR 3 description	DP 3 description

*FIG. 46B*



Parent Information:	
Number	Description
FR 1.1	Manage design workflow
DP 1.1	Management roadmap

FR Information:		DP Information:	
Number	Description	Number	Description
FR#.1	Provide security	DP#.1	Login privilege
FR#.2	Assign tasks	DP#.2	Resource of de...
FR#.3	Manage schedule	DP#.3	Schedule—mana...
FR#.4	Construct design h...	DP#.4	Data structure f...
FR#.5	Facilitate changes...	DP#.5	ECO handling t...

FIG. 47A

	FR	DP
Parent	Parent FR description	Parent DP description
1	FR 1 description	DP 1 description
2	FR 2 description	Alternative DP 2(a)
		Alternative DP 2(b)
		Alternative DP 2(c)
3	FR 3 description	DP 3 description

FIG. 47B

Parent Information:	
Number	Description
FR 1.1	Manage design workflow
DP 1.1	Management roadmap

FR Information:		DP Information:	
Number	Description	Number	Description
FR#.1	Provide security	DP#.1	Login privilege
FR#.2	Assign tasks	DP#.2	Resource of de...
FR#.3	Manage schedule	DP#.3	Schedule-mana...
FR#.4	Construct design h...	DP#.4	Data structure f...
FR#.5	Facilitate changes...	DP#.5	ECO handling t...

FIG. 48A

#: 1.2.3	FR	DP
Parent	Parent FR description	Parent DP description
#.1	FR 1 description	DP 1 description
#.2	FR 2 description	Alternative DP 2(a)
		Alternative DP 2(b)
		Alternative DP 2(c)
#.3	FR 3 description	DP 3 description

FIG. 48B

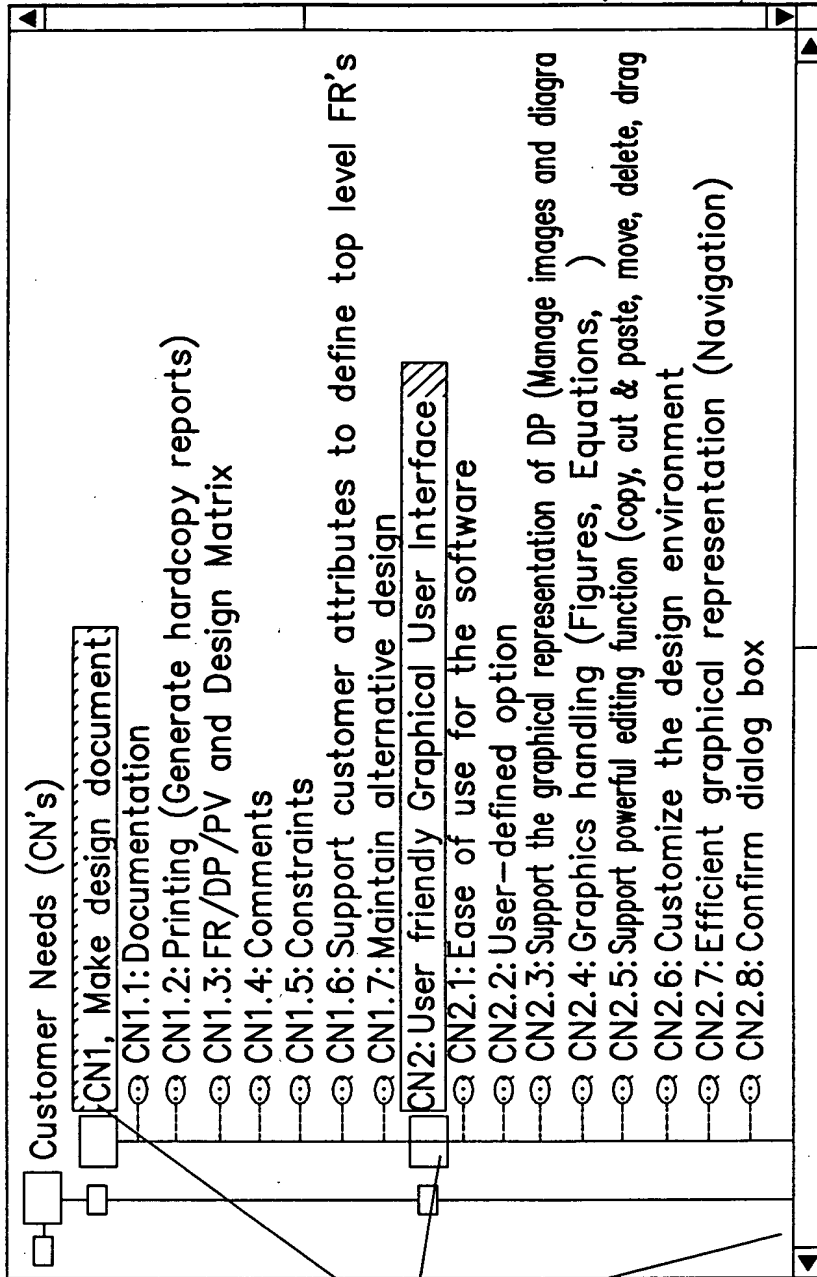
Constraint Information:						
Num...	Descr...	FR#1	FR#2	FR#3	FR#4	FR#5
C#1	Make...	X	X	X	X	X
C#2	Supp...	X	X	X	X	X
C#3	Elimi...	X	X	X	X	X
C#4	Facilit...	X	X	X	X	X
C#5	Funct...			X	X	
C#6	Obie...			X	X	

FIG. 49A

Mapping		Constraints		Robust Design		Analysis	
Index		Information		Target value			
#	Category	Type	Constraints	Comments	Operator	Target	Calculated
1	Critical	Marke	Weight	<input checked="" type="checkbox"/>	Less than (<+)	300lb	
2	Interface	Field	Cost	<input type="checkbox"/>	More than(>=)	\$500	
3	Project	Manu	Volume	<input checked="" type="checkbox"/>	Exact (==+/-)	10cu	

	C#1	C#2	C#3	CA's
FR#1	X			<input checked="" type="checkbox"/>
FR#2	X	X		<input type="checkbox"/>
FR#3	X		X	<input type="checkbox"/>
FR#4	X			<input checked="" type="checkbox"/>

FIG. 49B




	C#1	C#2	C#3	CA's
FR#1	X			<input checked="" type="checkbox"/>
FR#2	X	X	X	<input type="checkbox"/>
FR#3	X		X	<input type="checkbox"/>
FR#4	X			<input checked="" type="checkbox"/>

FIG. 50

Index #	Information				Target Value	
	Category	Type	Constraints	Comments	Operator	Target
1	Critical	Marke	Weight	<input checked="" type="checkbox"/>	Less than (<+)	300lb
2	Interface	Field	Cost	<input type="checkbox"/>	More than(>=)	\$500
3	Project	Manu	Volume	<input checked="" type="checkbox"/>	Exact (==+/-)	10cu

**FIG. 51**

 Edit Functional Requirements

X

The Current Functional Requirement is:

Please start with VERB for description.

Data Input

Description:

Support user friendliness of the software

Keyword:

User friendly

Comment:

The GUI is one of the most important features of the AD software.  
The design of the GUI will be discussed later.

Template: Process

Verification: Testing

☒ Clean

Insert

Append

Change

Delete

Cancel

FIG. 52A

Parent Information		
Nu...	Description	Comment
FR 1	Make a decision-making tool whi...	A software tool for decision maki...
DP 1	Computerized system with the A...	Software for Axiomatic Design.
DP Information:		
Num...	Description	Comm...
DP#.1	Management ro...	
DP#.2	Decision-making...	
DP#.3	Graphical User...	
DP#.4	Data-managing...	
DP#.5	Plug-in software	

FR Information:		
Num...	Description	Comment
FR#.1	Manage desi...	The design a...
FR#.2	Provide decis...	The FR deal...
FR#.3	Support user...	The GUI is a...
FR#.4	Provide effici...	All kinds of d...
FR#.5	Provide utility...	The fundam...

FIG. 52B

Index #	Template	Information		Comment		App. Link
		FR	DP	FR	DP	
Parent		Control the FR/DP domain	FR/DP window	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1		Control the mapping	Mapping tab	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
2		Assign constraints	Domain tab	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
3		Refine the design	Constraints tab	<input type="checkbox"/>	<input type="checkbox"/>	
4		Analyze the design	Robust design tab	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
			Analysis tab	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

FIG. 52C

			DP1						DP2					
			DP11		DP12		DP13		DP21		DP22			
			DP111	DP112	DP121	DP122	DP131	DP132	DP211	DP212	DP213	DP221	DP222	DP23
FR1	FR11	FR111	X											
		FR112		X										
	FR12	FR121			X									
		FR122				X								
	FR13	FR131					X							
		FR132						X						
FR2	FR21	FR211							X					
		FR212								X				
		FR213									X			
	FR22	FR221	X		X		X		X	X	X	X		
		FR222		X		X		X	X	X	X		X	
	FR23		X	X	X	X	X	X	X	X	X		X	X

FIG. 53








 FR/DP	 Design Matrix	 Analysis																												
Parent Information:																														
Number	Description																													
FR 1.1	Manage design workflow																													
DP 1.1	Management roadmap																													
<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;">           FR Information:           <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Numb...</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>FR#.1</td><td>Provide security</td></tr> <tr><td>FR#.2</td><td>Assign tasks</td></tr> <tr><td>FR#.3</td><td>Manage Sched...</td></tr> <tr><td>FR#.4</td><td>Construct desi...</td></tr> <tr><td>FR#.5</td><td>Facilitate chan...</td></tr> <tr><td> </td><td> </td></tr> </tbody> </table> </div> <div style="width: 48%;">           DP Information:           <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Numb...</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>DP#.1</td><td>Login privilege</td></tr> <tr><td>DP#.2</td><td>Resource of d...</td></tr> <tr><td>DP#.3</td><td>Schedule-ma...</td></tr> <tr><td>DP#.4</td><td>Data structure...</td></tr> <tr><td>DP#.5</td><td>ECO handling...</td></tr> <tr><td> </td><td> </td></tr> </tbody> </table> </div> </div>			Numb...	Description	FR#.1	Provide security	FR#.2	Assign tasks	FR#.3	Manage Sched...	FR#.4	Construct desi...	FR#.5	Facilitate chan...			Numb...	Description	DP#.1	Login privilege	DP#.2	Resource of d...	DP#.3	Schedule-ma...	DP#.4	Data structure...	DP#.5	ECO handling...		
Numb...	Description																													
FR#.1	Provide security																													
FR#.2	Assign tasks																													
FR#.3	Manage Sched...																													
FR#.4	Construct desi...																													
FR#.5	Facilitate chan...																													
Numb...	Description																													
DP#.1	Login privilege																													
DP#.2	Resource of d...																													
DP#.3	Schedule-ma...																													
DP#.4	Data structure...																													
DP#.5	ECO handling...																													


FIG. 54A



FR/DP



Design Matrix



Analysis

### Design Matrix Table:

A1.1(1.1)	DP#.1	DP#.2	DP#.3	DP#.4	DP#.5
FR#.1	X	O	O	O	O
FR#.2	X	X	O	O	X
FR#.3	X	X	X	O	X
FR#.4	X	O	O	X	X
FR#.5	X	O	O	O	X

FIG. 54B





*FIG. 55A*



*FIG. 55B*

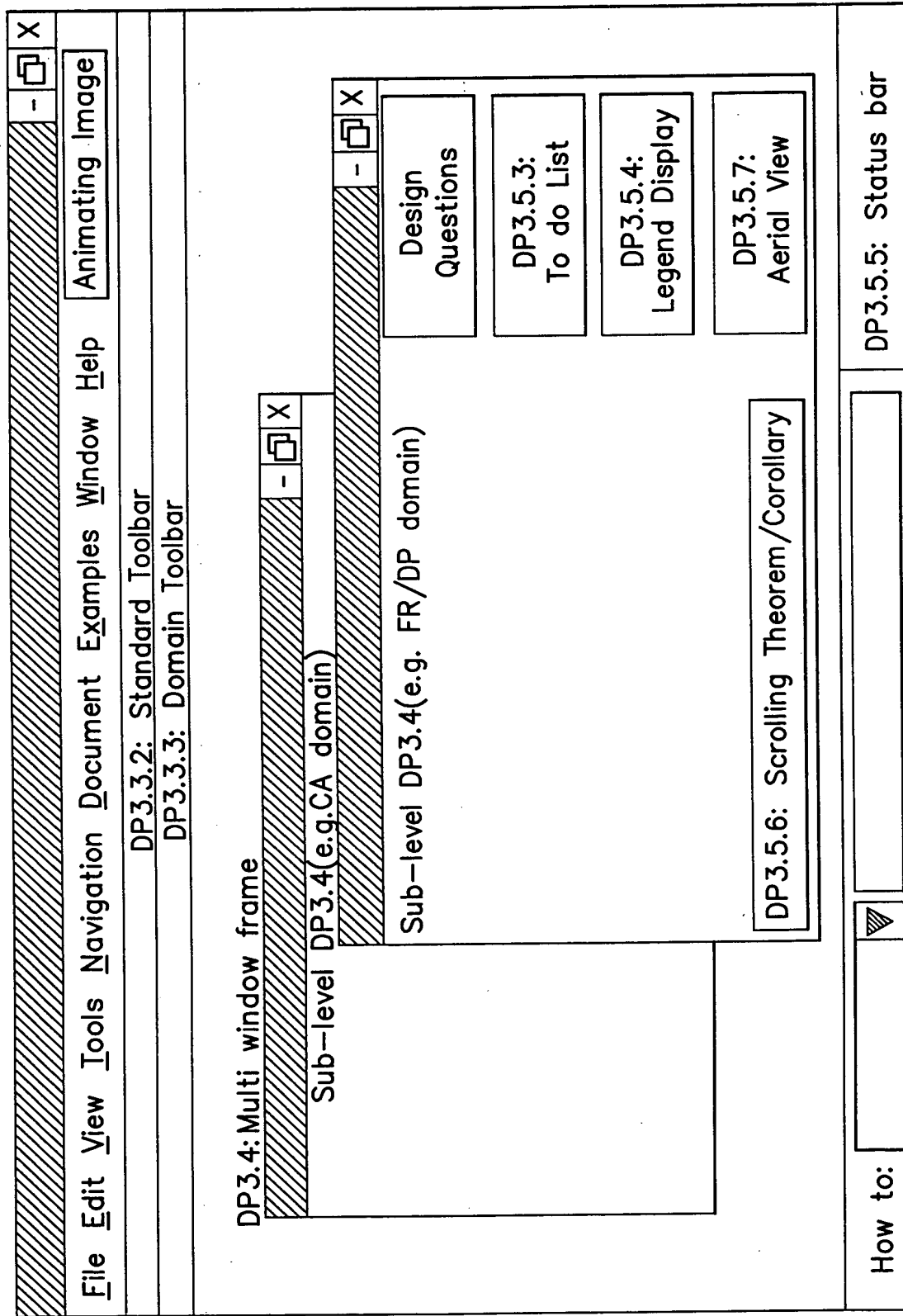


FIG. 56

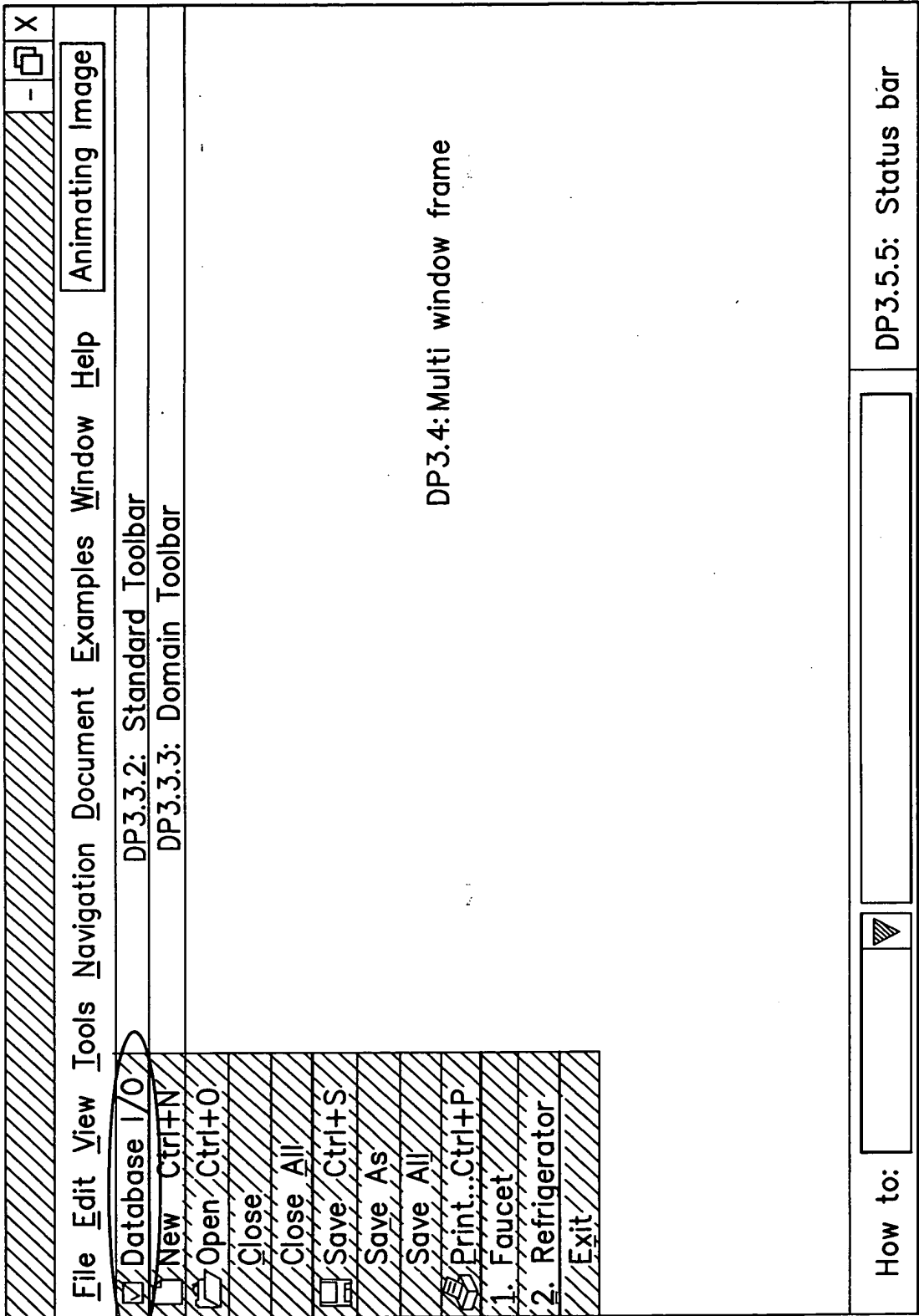


FIG. 57

Mapping		Constraints		Robust Design		Analysis		Design Questions	
Index #	Template	FR	Information	DP	Comment	FR	DP	App. Link	
Parent		Control the FR/DP domain	FR/DP window			<input checked="" type="checkbox"/>	<input type="checkbox"/>		Design Questions
1		Control the mapping	Mapping tab			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
2		Assign constraints	Constraints tab			<input type="checkbox"/>	<input checked="" type="checkbox"/>		
3		Refine the design	Robust design tab			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
4		Analyze the design	Analysis tab			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		DP3.5.3: To do List
									DP3.5.4: Legend Display
									DP3.5.7: Aerial View

	DP#1	DP#2(a)	DP#2(b)	DP#3	DP#4
FR#1	X				
FR#2	X	X			
FR#3	X	X	X		X
FR#4	X		X		

Alt.	Set.	R/R	Dec.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Measure of Coupling:	Information Contents:

DP3.5.6: Scrolling Theorem/Corollary

FIG. 58

Mapping		Constraints		Robust Design		Analysis	
Index	Template	FR	Information	DP	FR	DP	App. Link
Parent		Control the FR/DP domain	FR/DP window		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1		Control the mapping	Mapping tab		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
2		Assign constraints	Domain tab		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
3		Refine the design	Constraints tab		<input type="checkbox"/>	<input type="checkbox"/>	
4		Analyze the design	Robust design tab		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
			Analysis tab		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Alt.	Design Questions
DP3.5.3: To do List	
DP3.5.4: Legend Display	
DP3.5.7: Aerial View	

FR#	DP#	DP#	DP#
1	2(a)	3	4
FR#1	X		
FR#2	X		
FR#3	X	X	
FR#4	X	X	X

Measure of Coupling: ☐ Information Contents: ☐

DP3.5.6: Scrolling Theorem/Corollary

Radio buttons for current choice

Make diagonal

Make triangular

Set

FIG. 59

Roadmap	Is this step finished?		Resources for control		
	Yes	No	Menu	Tab	Toolbar
Start the design process		Disable	View-> Project Control	Constraints, Robust design, Analysis	Project Control
Activities at one level of the design hierarchy	Enable		----->	Constraints	
		Disable			
Define Design Matrix	Enable			Analysis	
		Disable			
Define leaf level	Enable		View-> Project Control	Robust Design	Project Control
		Disable			

FIG. 60A FIG. 60B

FIG. 60A



A

Resources for control				
Buttons				
In Mapping tab	In Constraint tab	In Analysis tab	In Robust Design	
One step design matrix control buttons				
Decompose				
Decompose		Flow Chart, Impact List, Check consistency		
		Flow Chart, Impact List, Check consistency		
		Check Constraints, Audit		
		Check Constraints, Audit		

B

FIG. 60B

[illegible]

FIG. 61

Mapping		Constraints		Robust Design		Analysis	
Index	Template	FR	Information	DP	FR	DP	App. Link
Parent		Control the FR/DP domain	Mapping tab		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1		Control the mapping	Domain tab		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
2		Assign constraints	Constraints tab		<input type="checkbox"/>	<input type="checkbox"/>	
3		Refine the design	Robust design tab		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4		Analyze the design	Analysis tab		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

	DP #.1	DP #.2(a)	DP #.2(b)	DP #.4	DP #.4
FR #.1	X				
FR #.2	X	X			
FR #.3	X	X	X		
FR #.4	X		X	X	X

Design Questions	
DP3.5.3: To do List	
DP3.5.4: Legend Display	
DP3.5.7: Aerial View	

Measure of Coupling:	Information Contents:
DP3.5.6: Scrolling Theorem/Corollary	

FIG. 62

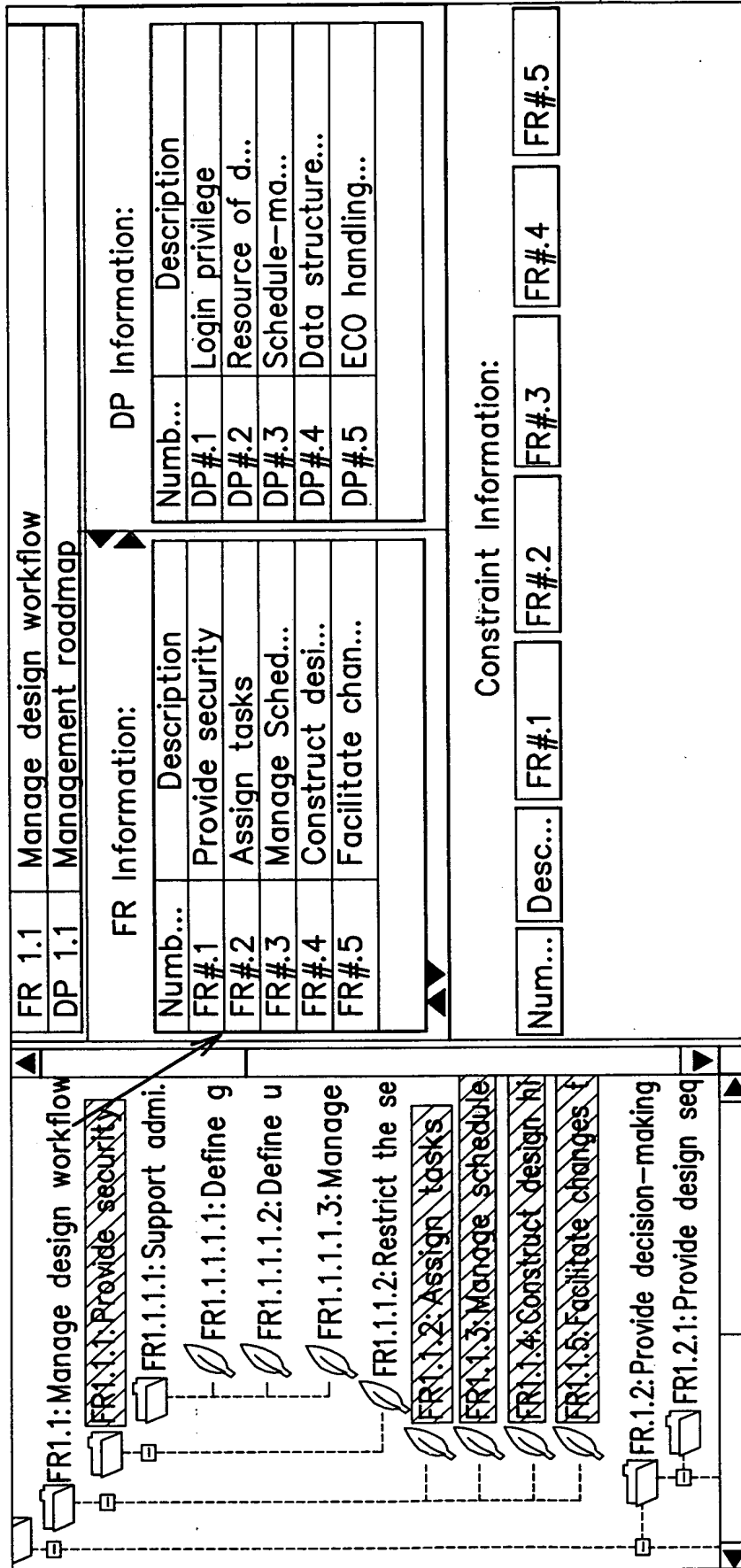


FIG. 63A

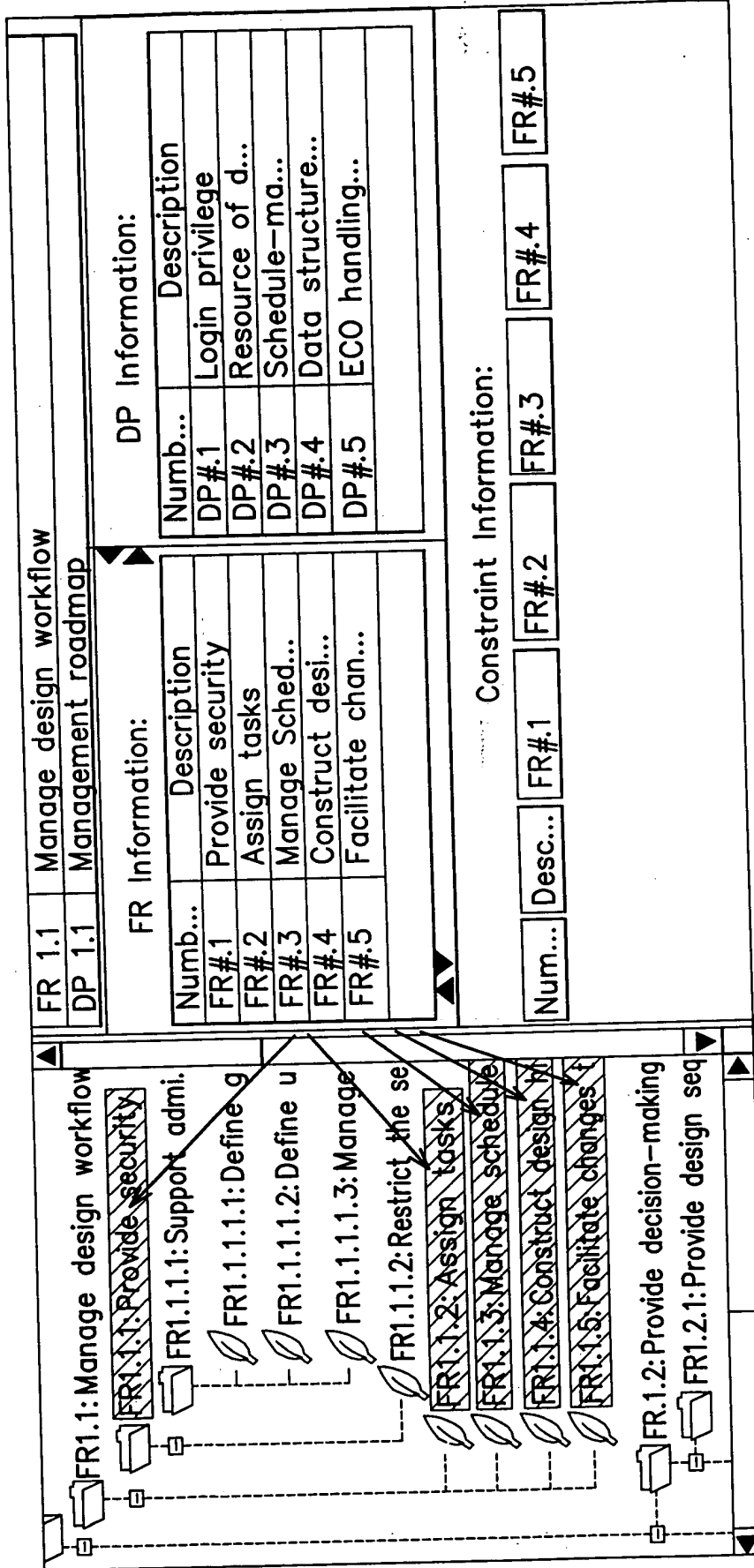






FIG. 63B

Is	Navigation	Document		
	 Goto Parent	d	T	
	 Goto Child	n	T	
	 Goto previous Sibling			
	 Goto next Sibling			

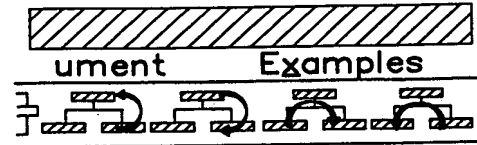


FIG. 64

Control Item	Level 1	Level 2	Level 3	Level 4	Level 5
	Beginner		Intermediate		Expert
FR/DP Mapping	●	●	●	●	●
Design Matrix	●	●	●	●	●
Alternative DP		●	●	●	●
Analysis-Flow Chart		●	●	●	●
Constraints			●	●	●
Comments			●	●	●
CN			●	●	●
CN/FR Mapping			●	●	●
Analysis-Child List			●	●	●
Analysis-Impact List			●	●	●
DP/PV Mapping				●	●
Analysis-Check Consistency				●	●
Analysis-Check Constraints				●	●
Templates				●	●
Verification				●	●
Application Link				●	●
Analysis-Audit					●
Nested(Full) Matrix Handling					●
Robust Design					●
Project Control					●

Available Features

FIG. 65A

FIG. 65B

FIG. 65C

FIG. 65A

B

A

Automatic Menu Control (Enables the marked item)									
File Menu	Database I/O								
View Menu	CN Domain								
	FR/DP Domain								
	DP/PV Domain								
	Nested(Full)Matrix								
Preference menu	Project Control								
	Display Configuration Manag								
	Numbering								
	Design Matrix								
	Display Color								
	Design Matrix Color								
	GUI Display								
	File Location								
Document Menu	Resource								
	Database I/O								
	Templates								
	Constraints								
	Verifications								
	PV Tree Diagram								
	Nested Full Matrix								

(D)

(C)

FIG. 65B





		Default Numbering	Alternative Numbering	Example
Numbering Type	Numeric	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1, 2, 3
	Lower case	<input type="checkbox"/>	<input checked="" type="checkbox"/>	a, b, c
	Upper case	<input type="checkbox"/>	<input type="checkbox"/>	A, B, C
Indicator	Alternative connector	()		Defined by user
	Parent index	#		
	Divider			
Example		<div><div>#=1<div>FR 1<div>FR #.1<div>FR #.2<div>FR #.1<div>FR #.2</div></div></div></div></div><div>#=1.2<div>FR #.1<div>FR #.2</div></div></div></div><div>#=1<div>DP 1<div>DP #.1<div>DP #.1(a)<div>DP #.2<div>DP #.2(a)</div></div></div></div></div></div></div>		

FIG. 66

Description	Element	Weight factor
No effect	0	0
Small effect	x	1
Large effect	X	2
Unknown	?	1
Number		

A

FIG. 67A    FIG. 67B

FIG. 67A

[illegible]

**FIG. 67B**



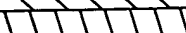



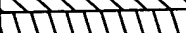


		Legend category		
		Color	Font	Line
Display	Activated cell			N/A
	Normal			
	Default			N/A
	Focus			N/A
	Alternative			N/A
	Redundant			N/A
	Constraints			N/A
	Comments			N/A
Design Matrix	Uncoupled		N/A	
	Decoupled		N/A	
	Coupled		N/A	
	Undefined		N/A	
Template	Process			—
	Transport			---
	...			

FIG. 68

			<input type="button" value="Help"/>	
	FR: 53/DP: 53	Academic user	dshee	Wed 1/26/2000

*FIG. 69*

09731579.04501  
T09T40" 829TE260

Mapping

Constraints

Robust Design

Analysis

Comment

Index

Information

**Mapping**

- \*What are the functions that the system/product should perform?
- \*How do you achieve these functions?
- \*Do you think this set of FRs is minimum set to fulfill the parent level requirements?
- \*Does changing this DP affect the FR?
- \*Does the choice of this DP affect that FR?
- \*Can the DP be designed without affecting the FR?
- \*...

Cmt	FR#2	FR#3	FR#4
/	X		X
△		X	X
Set.			
R/R			
Dec.			

Design Questions

DP3.5.3:  
To do List

DP3.5.4:  
Legend Display

DP3.5.7:  
Aerial View

Measure of Coupling:

Information Contents:

DP3.5.6: Scrolling Theorem/Corollary

FIG. 70

Mapping		Constraints		Robust Design		Analysis		Design Questions	
Alt.	Index #	Template	FR	Information	Comment	FR	DP	App. Link	
1			Control the FR/DP domain	FR/DP window		<input checked="" type="checkbox"/>	<input type="checkbox"/>		<div>DP3.5.3: To do List</div> <div>DP3.5.4: Legend Display</div> <div>DP3.5.7: Aerial View</div>
			Control the mapping	Mapping tab		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
				Domain tab		<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<p>*Due to the changes on DP xx, you have to check the impacts.</p> <p>*You didn't fill out the Design Matrix information at FR 1.2.x node.</p> <p>*You didn't fill out the constraint information on this node.</p> <p>*You didn't set up the relation for FR and CA.</p> <p>*...</p>									
FR#3	X			X					
FR#4	X			X				X	
<p>Measure of Coupling: <input type="checkbox"/> Information Contents: <input type="checkbox"/></p> <p>DP3.5.6: Scrolling Theorem/Corollary</p>									

FIG. 71



Rank/Rearrange the Design Matrix combination...

Change

Cancel

DP Ranking Assumptions

☒ Start FR/DP association
 ☐ Free association of DPs

Get Rank Combination

Display Options

☒ Number
 ☐ Description
 ☐ Keyword

Colors

Unknown design

Uncoupled Design

Decoupled Design

Coupled Design

Alternative DP

Redundant DP

Has Comment

Help

Matrix Information:

A0(1.1)	DP: #.1	DP: #.2(1)
FR: #.1	X	O
FR: #.2	O	X

Ranking Information:

FR: #.1	FR: #.2	Status	Off X's	Coupled X's
DP: #.1	DP: #.2(1)	Uncoupled	0/4	n/a
DP: #.1	DP: #.2	Uncoupled	0/4	n/a
DP: #.1(1)	DP: #.2(1)	Decoupled	1/4	n/a
DP: #.1(1)	DP: #.2	Decoupled	1/4	n/a
DP: #.1	DP: #.2(2)	Decoupled	1/4	n/a
DP: #.1(1)	DP: #.2(2)	Coupled	2/4	1

Rearrange Sequence:

Rearranged FR Order
No Rearrange
FR: 1-FR: 2-
FR: 2-FR: 1-

Design Matrix Table:

A0(1.1)	DP: #.1	DP: #.1(1)	DP: #.2	DP: #.2(1)	DP: #.2(2)
FR: #.1	X	X	O	O	X
FR: #.2	O	X	X	X	X

FIG. 72

Child List		Inconsistency	Decoupling
Number	FR Description	DP Description	
1.1	Manage design workflow	Management roadmap	
1.1.1	Provide security	Login privilege	
1.1.2	Assign tasks	Resource of design activity	
1.1.3	Manage schedule	Schedule-managing tool (e.g. MS Project)	
1.1.4	Construct design hierarchy	Data structure for Axiomatic Design concept	
1.1.5	Facilitate changes to the design	ECO handling tool	
1.1.1.1	Support administrative tool	User manager	
1.1.1.2	Restrict the security access level	Authority code	
1.1.1.1.1	Define group	Group specification	
1.1.1.1.2	Define user	User specification	
1.1.1.1.3	Manage authority code	Authority code specification	

FIG. 73

Design Matrix Table:

A1(1.1)	DP#1	DP#2	DP#3	DP#4	DP#5
FR#1	X	0	0	0	0
FR#2	X	X	0	0	0
FR#3	X	X	X	X	X
FR#4	X	X	0	X	0
FR#5	0	0	0	X	X

Child List Impact List Inconsistency Decoupling

Number	FR Description	DP Description
1.4.1	Support data file	File handling
1.4.2	Support database	Database handling
1.4.2.1	Provide consistency during data read a...	Data file format
1.4.2.2	Control error during read/write	Exception handling
1.4.2.3	Convert data from old version	Data file converter
1.4.2.4	Read data	Method for read
1.4.2.5	Write data	Method for write
1.4.2.6	Provide utility to deal with the program...	Method for utility
1.5	Provide utility function	Plug-in software
1.5.1	Handle external applications	Standard interface for external appli...
1.5.2	Teach the axiomatic design concept	Education software
1.5.3	Simulate the system architecture	Simulation software
1.5.4	Draw the Design Parameter figure	CAD Software
1.5.5	Analyze the system performance	Analysis software(i.e. ANSYS, NAS...
1.3	Support user friendliness of the software	Graphical User Interface software

Get data

Display Options  
☐ Number  
☐ Description  
☐ Keyword

Colors

Uncoupled Design  
Decoupled Design  
Coupled Design  
No Effect  
Has Effect  
Has Comment

Help

FIG. 74

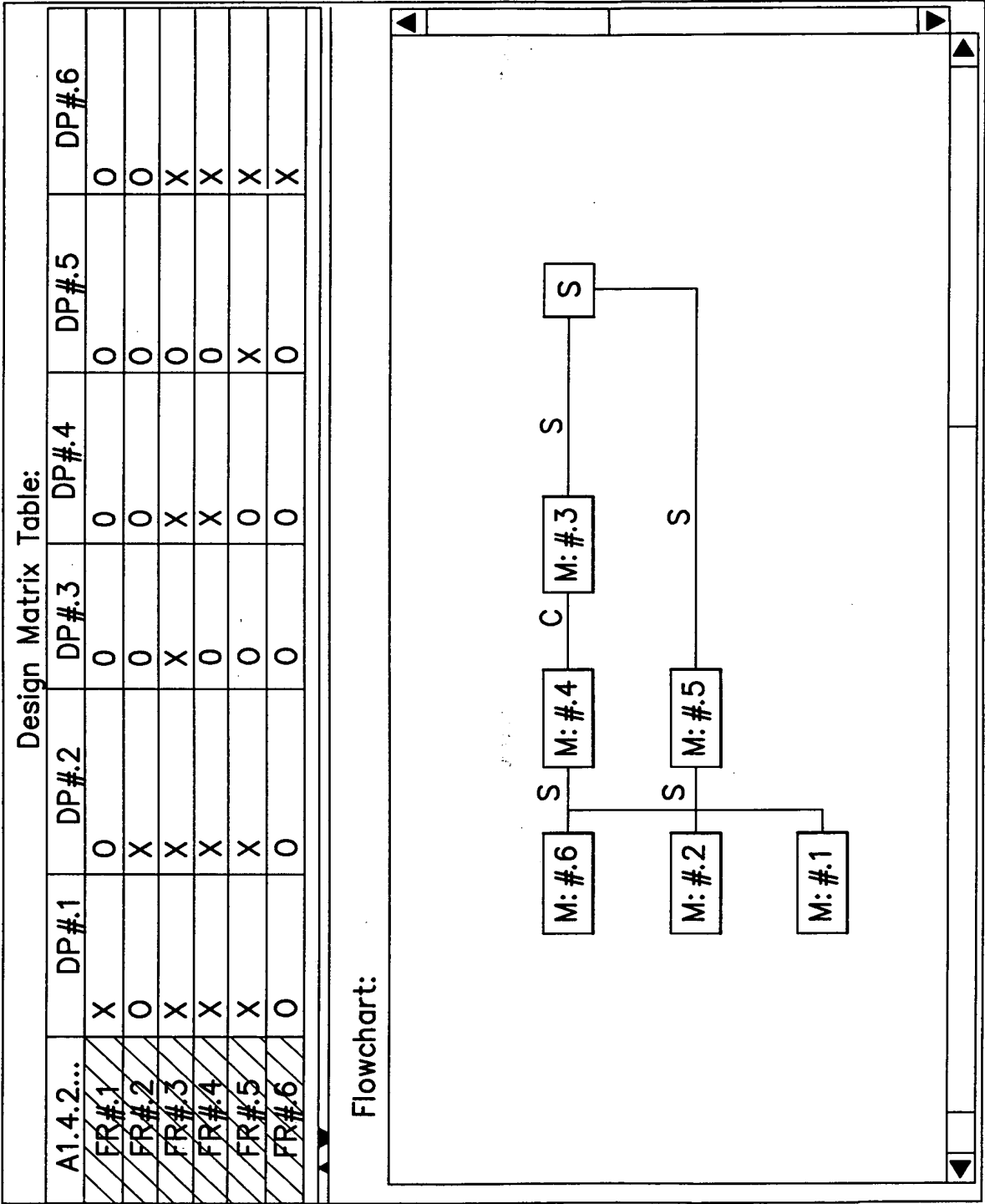
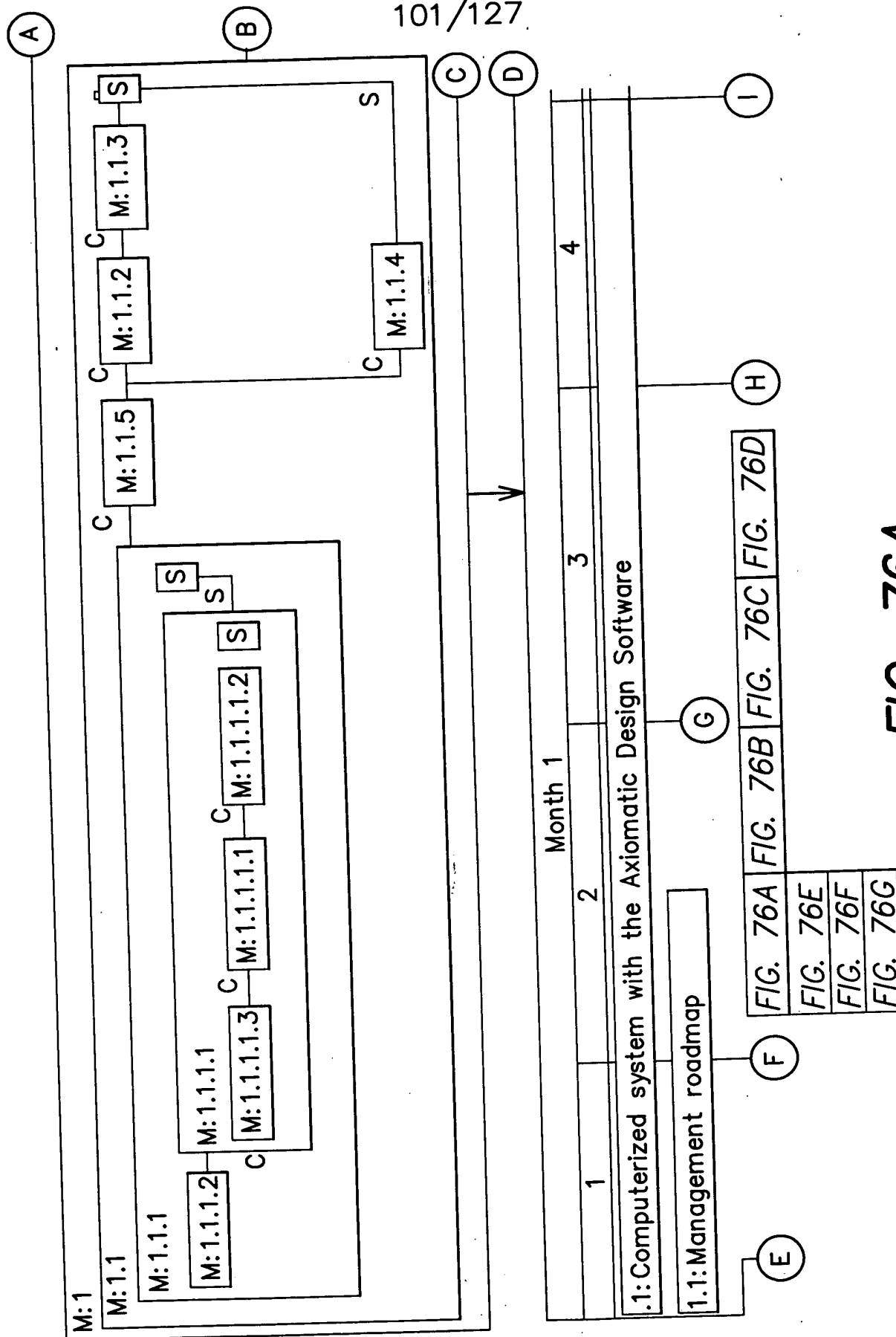


FIG. 75



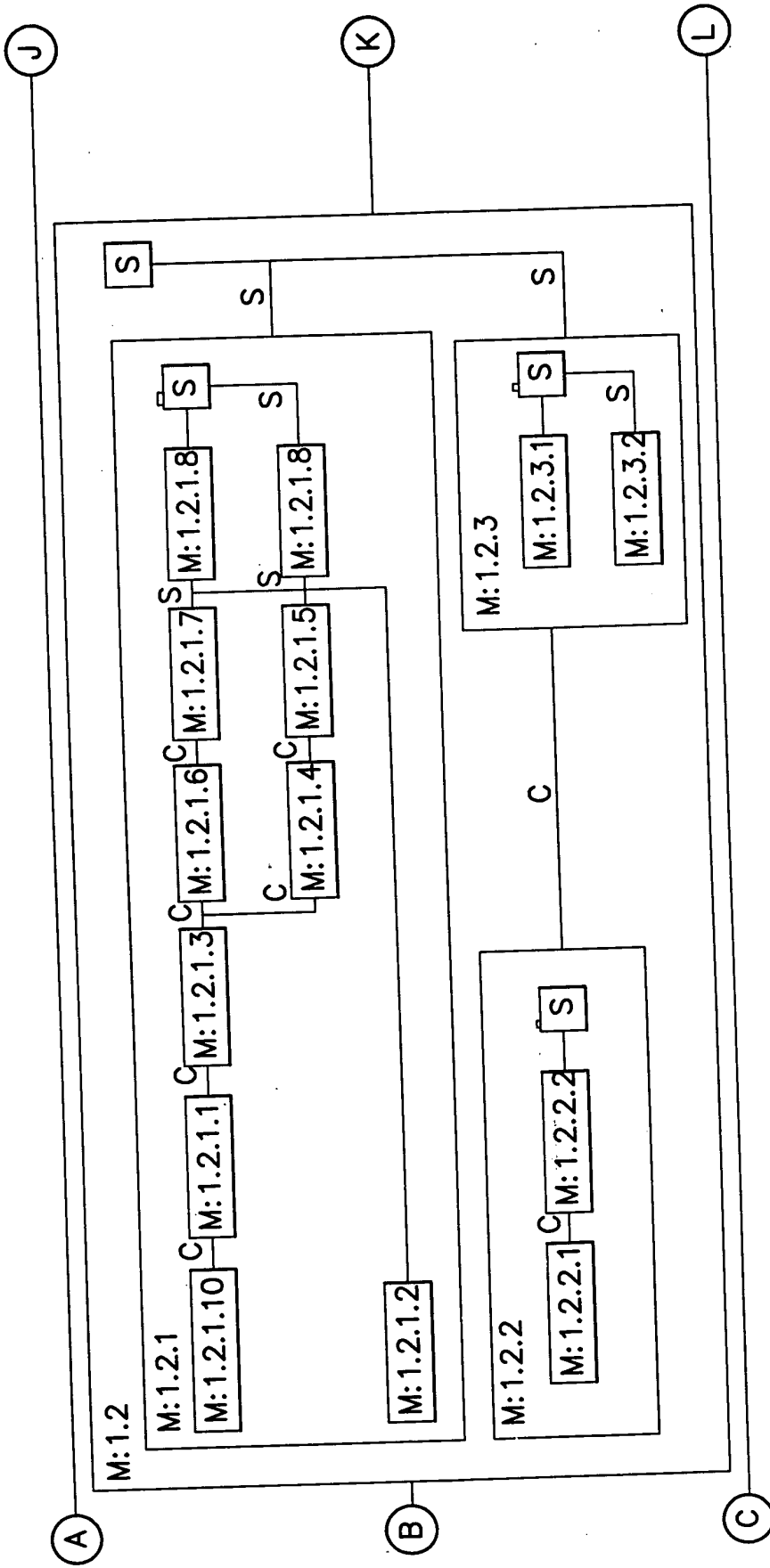
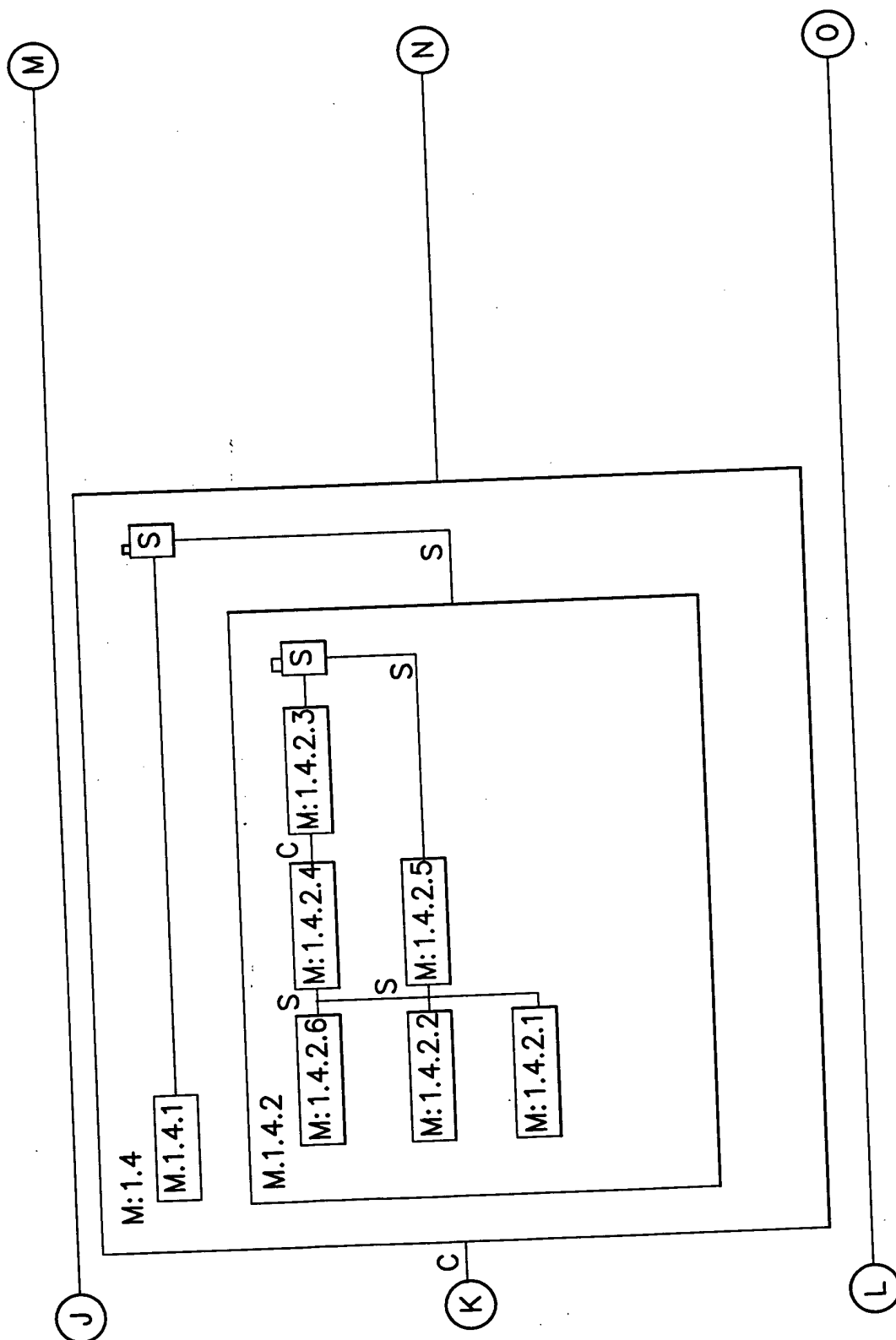


FIG. 76B



TEST 40-B 29 FEB 260

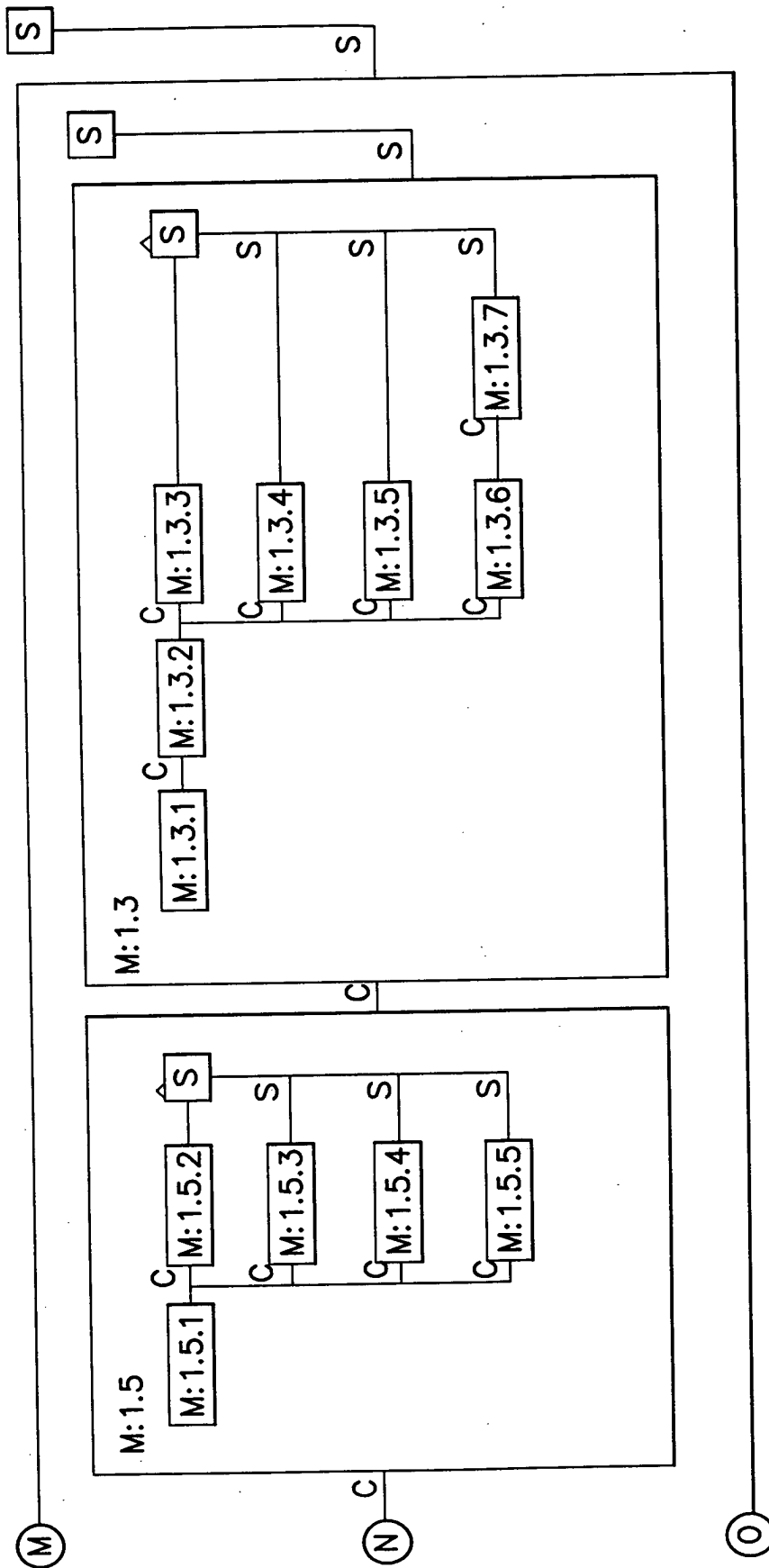


FIG. 76D



E	F	G	H	I
	<div data-bbox="406 1465 457 1801">1.1.1:Login privilege</div> <div data-bbox="487 1438 539 1795">1.1.2:Authority code</div> <div data-bbox="548 1381 592 1726">1.1.1.1:User manager</div> <div data-bbox="597 1117 641 1726">1.1.1.1.3:Authority code specification</div> <div data-bbox="646 1228 690 1684">1.1.1.1.1:Group specification</div> <div data-bbox="695 1171 738 1606">1.1.1.1.2:User specification</div> <div data-bbox="743 1117 787 1507">1.1.1.5:ECO handling tool</div>	<div data-bbox="795 844 841 1396">1.1.2:Resource of design activity</div> <div data-bbox="847 520 893 1327">1.1.3:Schedule-managing tool (e.g. MS Project)</div> <div data-bbox="901 541 945 1396">1.1.4:Data structure for Axiomatic Design concept</div>		
		<div data-bbox="954 802 998 1297">1.2:Decision-making criterion</div> <div data-bbox="1006 760 1052 1297">1.2.1:Axiomatic Design roadmap</div> <div data-bbox="1063 892 1107 1297">1.2.1.10:Synonym library</div> <div data-bbox="1117 814 1161 1222">1.2.1.1:Rules set for CA</div> <div data-bbox="1169 781 1214 1192">1.2.1.3:Rule set for FRs</div>		
		<div data-bbox="1221 424 1263 991">1.2.1.6:Rule set for Design Matrix</div> <div data-bbox="1269 321 1312 865">1.2.1.7:Rule set for consistency</div> <div data-bbox="1318 466 1360 835">1.2.1.8&gt;Error message</div> <div data-bbox="1367 331 1409 865">1.2.1.4:Rule set for constraints</div>		

FIG. 76E

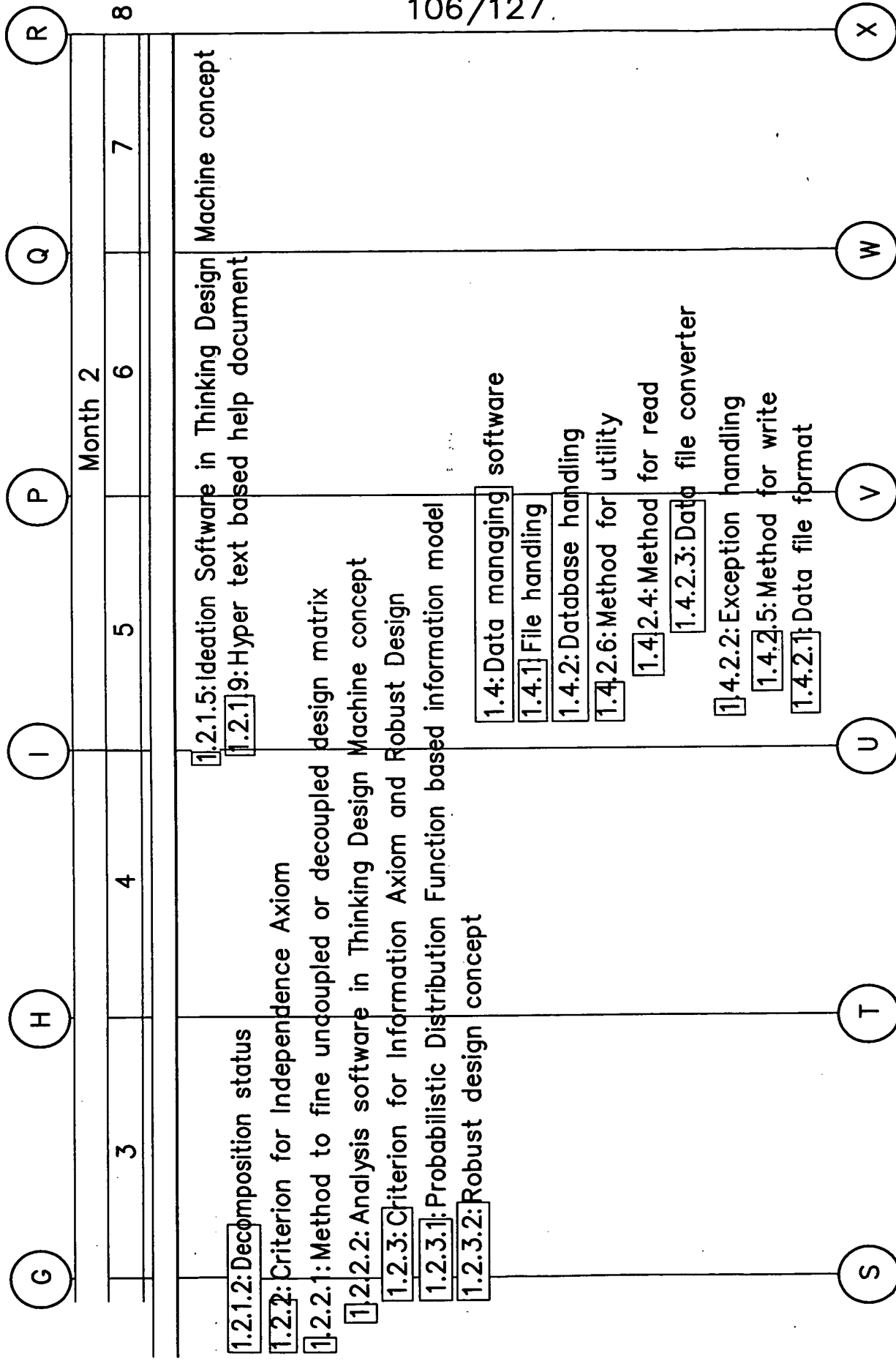


FIG. 76F

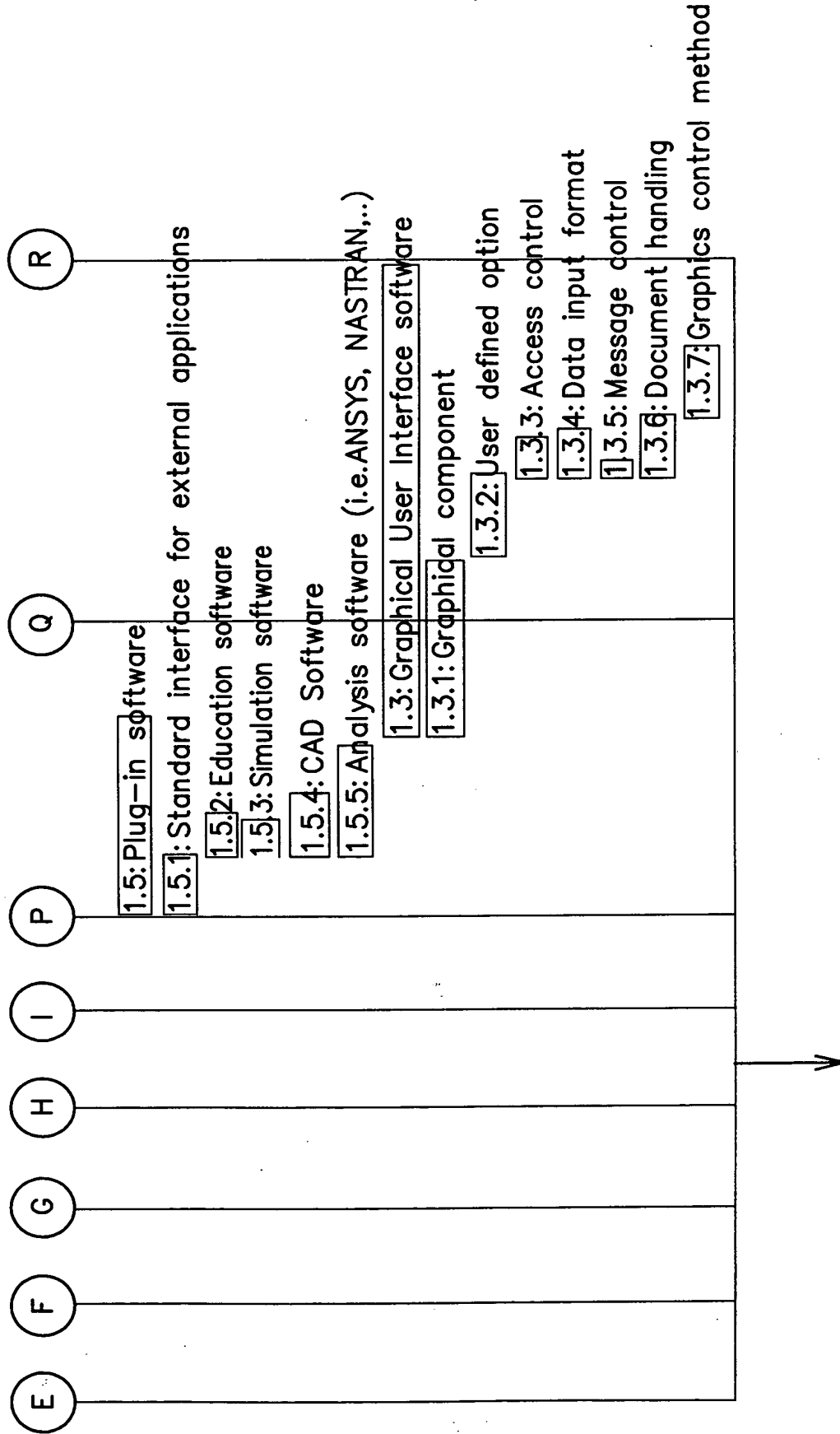


FIG. 76G

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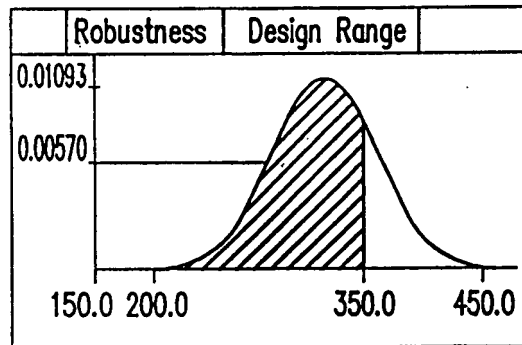


FIG. 77A

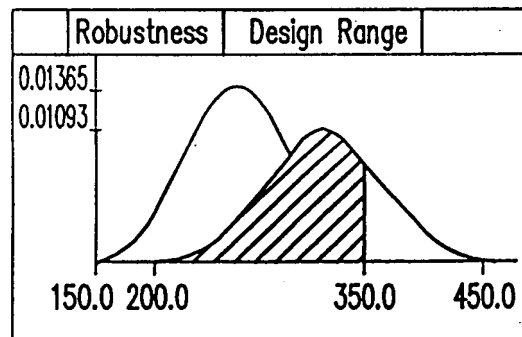


FIG. 77B

109140-BZ9TE260

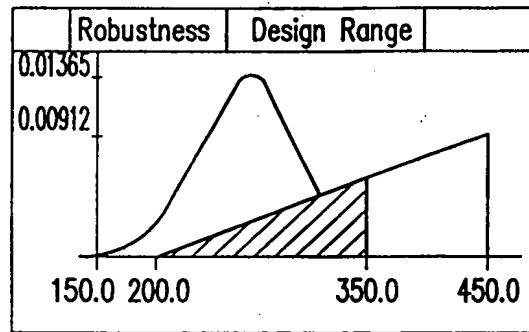


FIG. 77C

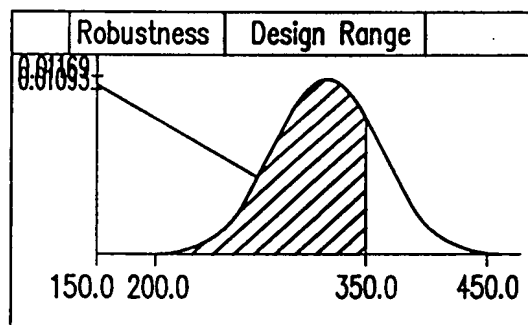


FIG. 77D

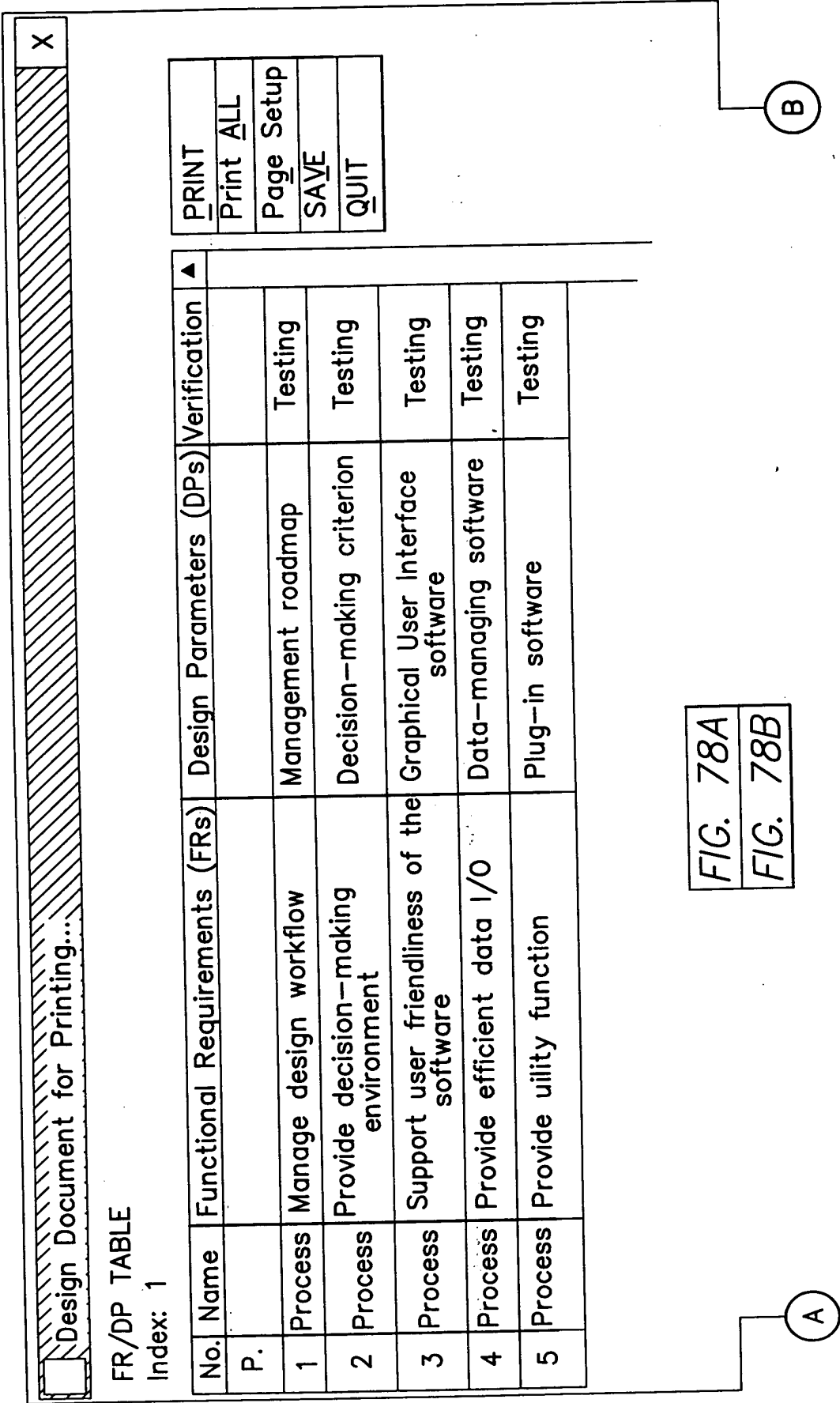


FIG. 78A

**A**

**B**

**Total Design Matrix Information**

	DP.#.1	DP.#.2	DP.#.3	DP.#.4	DP.#.5
FR.#.1	X	0	0	0	0
FR.#.2	X	X	0	0	0
FR.#.3	X	X	X	X	X
FR.#.4	X	X	0	X	0
FR.#.5	0	0	0	X	X

**Related Constraints**

No.	Parent	Keyword	Description	Comment	1	2	3	4	5	Verification
1	Designer	Impact	Make Impacts		*	*	*	*	*	Testing
2	Marketing	Speed	Support running as fast as possible		*	*	*	*	*	Testing
3	Designer	Bug	Eliminate bugs		*	*	*	*	*	Testing
4	Marketing	External Application	Facilitate use with external applications		*	*	*	*	*	Testing
5	Marketing	Multi-platform	Functions across platforms				*	*	*	Testing

Page Information

Page: 1

Document Format

☒ Customer Needs

☒ FR.DP.PV Table

☐ FR.DP.PV Comment

☒ Constraints

☒ Design Matrix

☐ Design Matrix Comment

☐ Default Display

☒ Full Display

SET

FIG. 78B

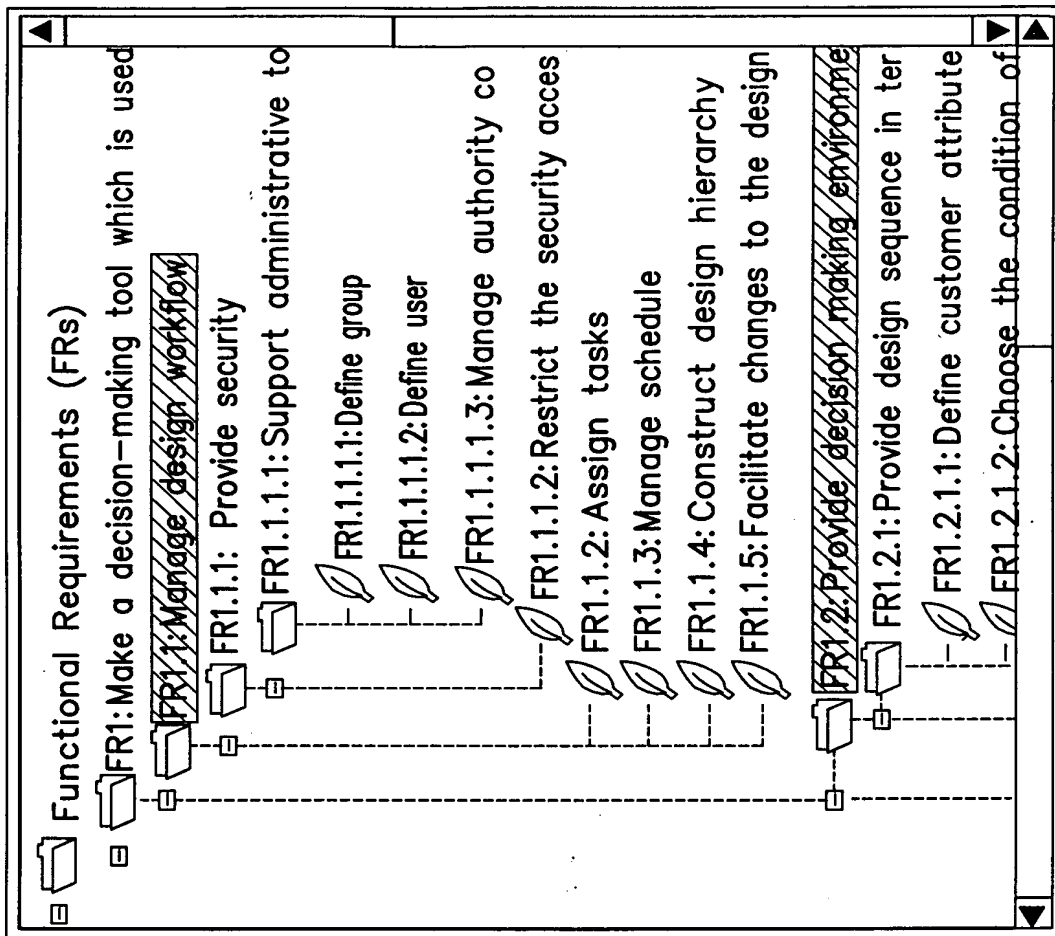


FIG. 79A



**FIG. 79B**

Mapping					Constraints		Robust Design		Analysis		Design Questions	
					DP #.2(a)		DP #.2(b)		DP #.3		DP #.4	
FR #.1	X											
FR #.2	X			X								
FR #.3	X						X					
FR #.4	X						X					
<p>Check my design:</p> <ul style="list-style-type: none"> <li>-Is the design completely uncoupled/decoupled?</li> <li>-Does it satisfy Constraints?</li> <li>-Does each leaf DP have a drawing?</li> <li>-Are there any unchecked CN's?</li> <li>-Has everybody done consistency check?</li> <li>-Does the default design have the least information?</li> <li>-Are all the leaf nodes checked as leaf?</li> <li>-...</li> </ul>												
<p>DP3.5.6: Scrolling Theorem/Corollary</p>												
<p>DP3.5.3: To do List</p>												
<p>DP3.5.4: Legend Display</p>												
<p>DP3.5.7: Aerial View</p>												

FIG. 80

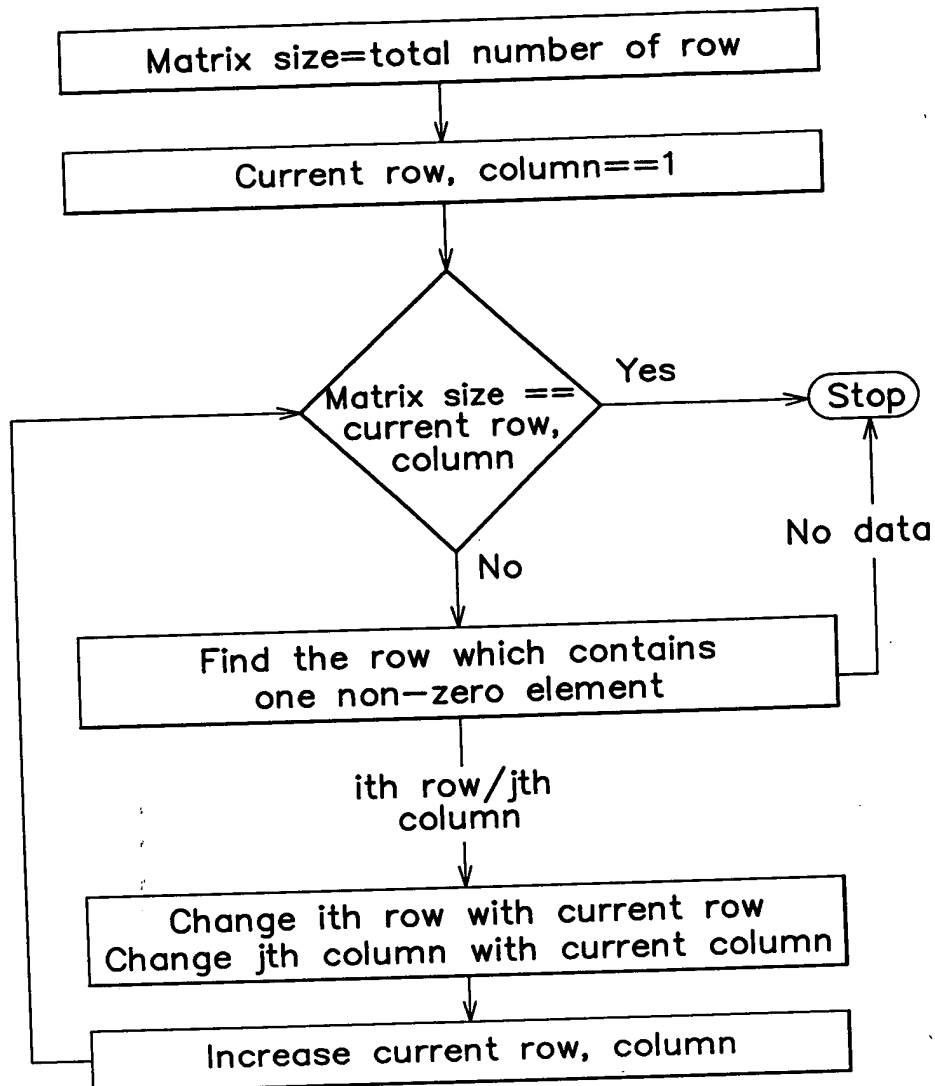


FIG. 81

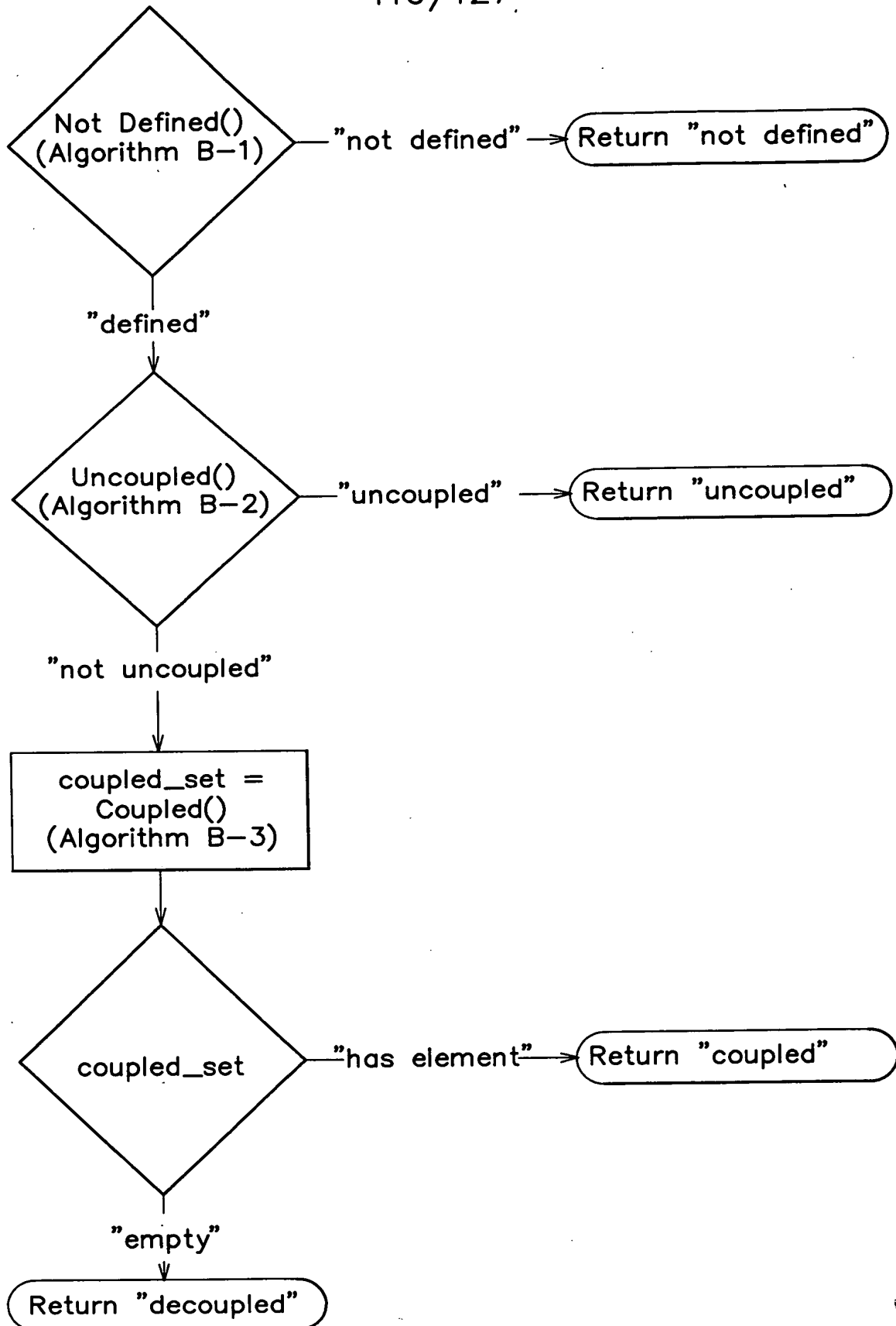


FIG. 82

```

Loop One (int row=0; row<total_row_number; row++) {
  Loop Two (int column=0; column <total_column_number; column++) {
    If(maxtrix[row][column] == "empty")
      return "not defined"

    If(row == column) {
      If(matrix[row][column] == "O")
        return "not defined"
    }
  }
}

return "defined"

```

If one of the diagonal element has "O", the design is not defined in terms of the axlomatic design viewpoint

FIG. 83

```

Loop One (int row=0; row<total_row_number; row++) {
  Loop Two (int column=0; column <total_column_number; column++) {
    If(row != column) {
      If(matrix[row][column] == "X")
        return "not uncoupled"
    }
  }
}

return "uncoupled"

```

FIG. 84

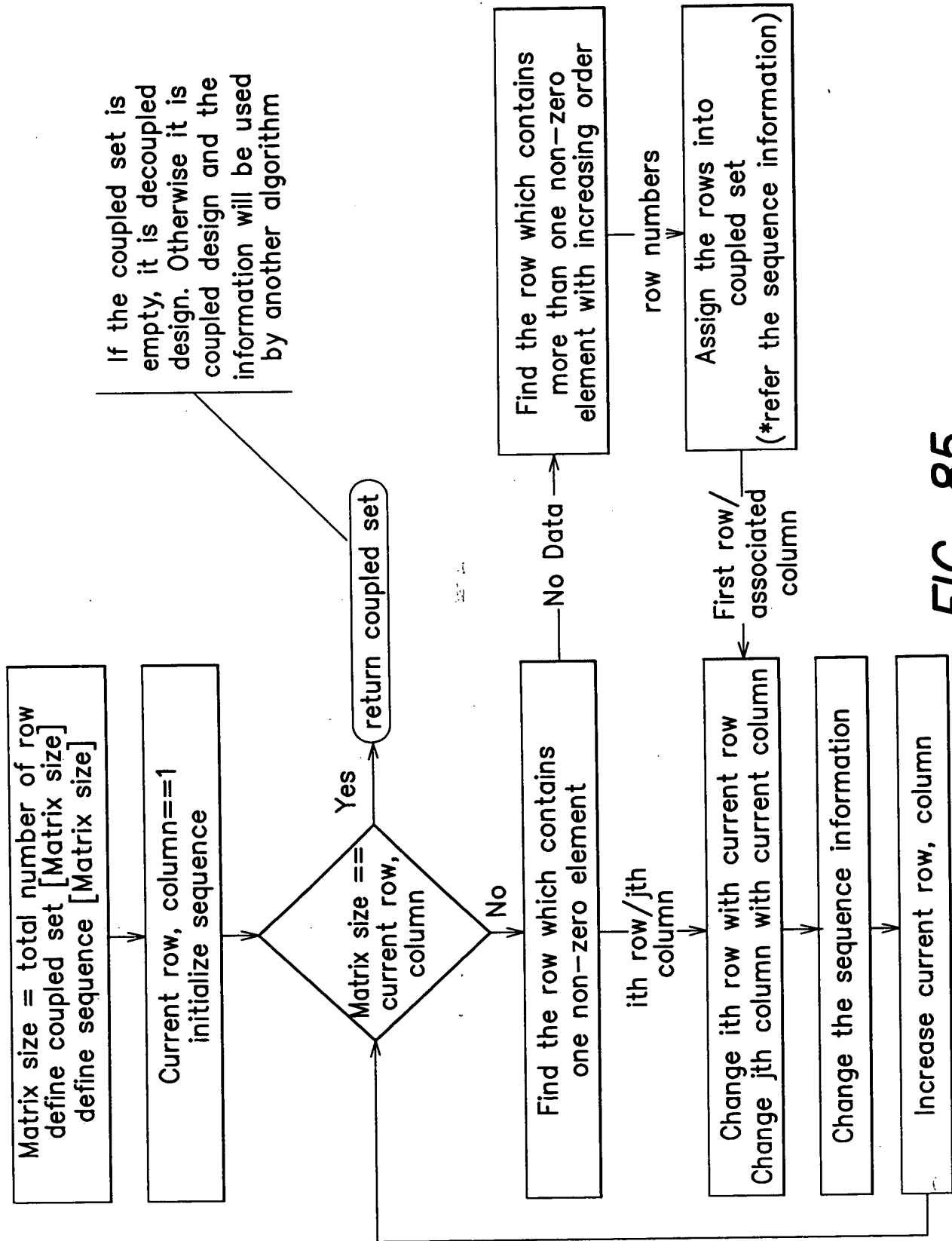


FIG. 85

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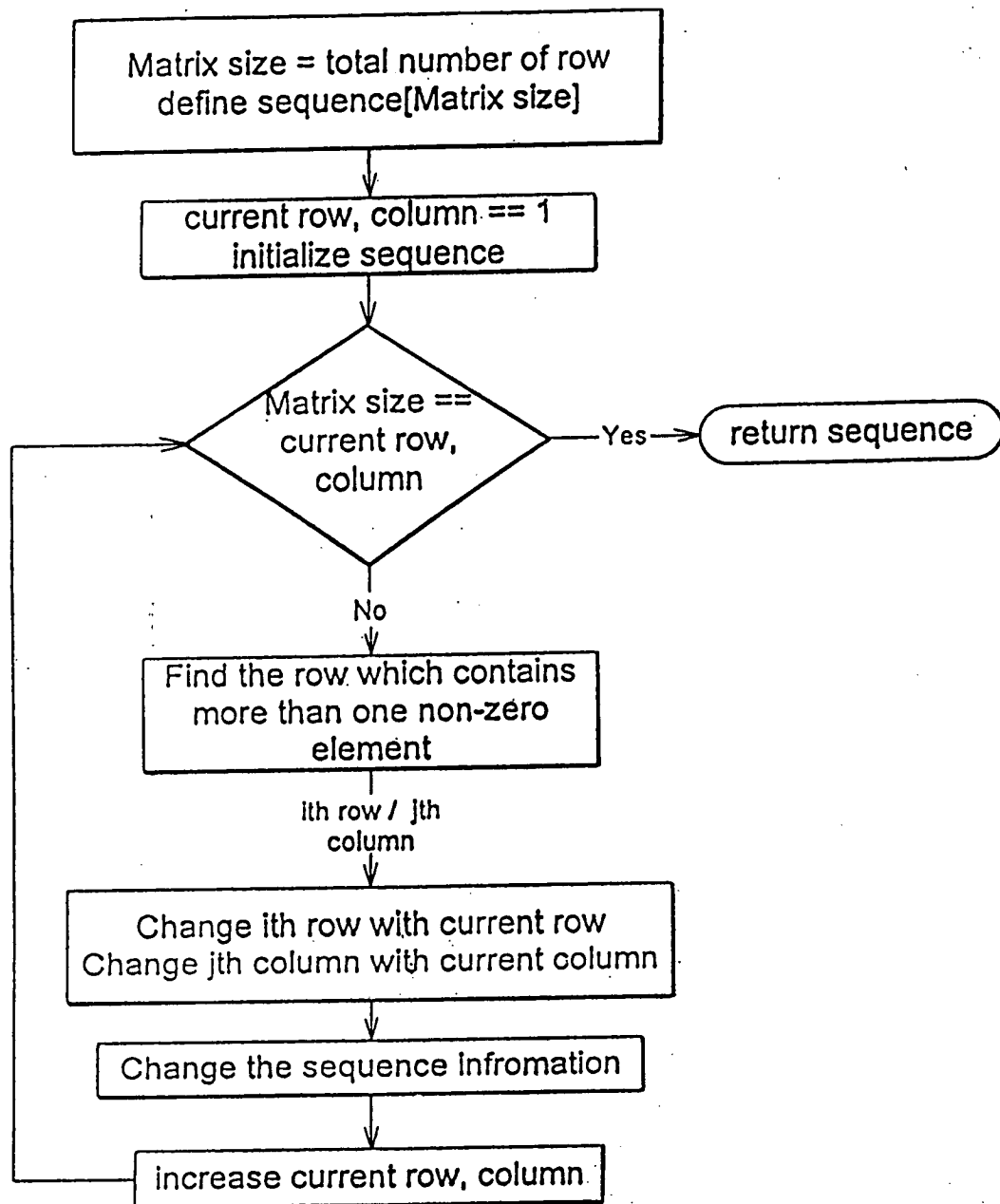


FIG. 86

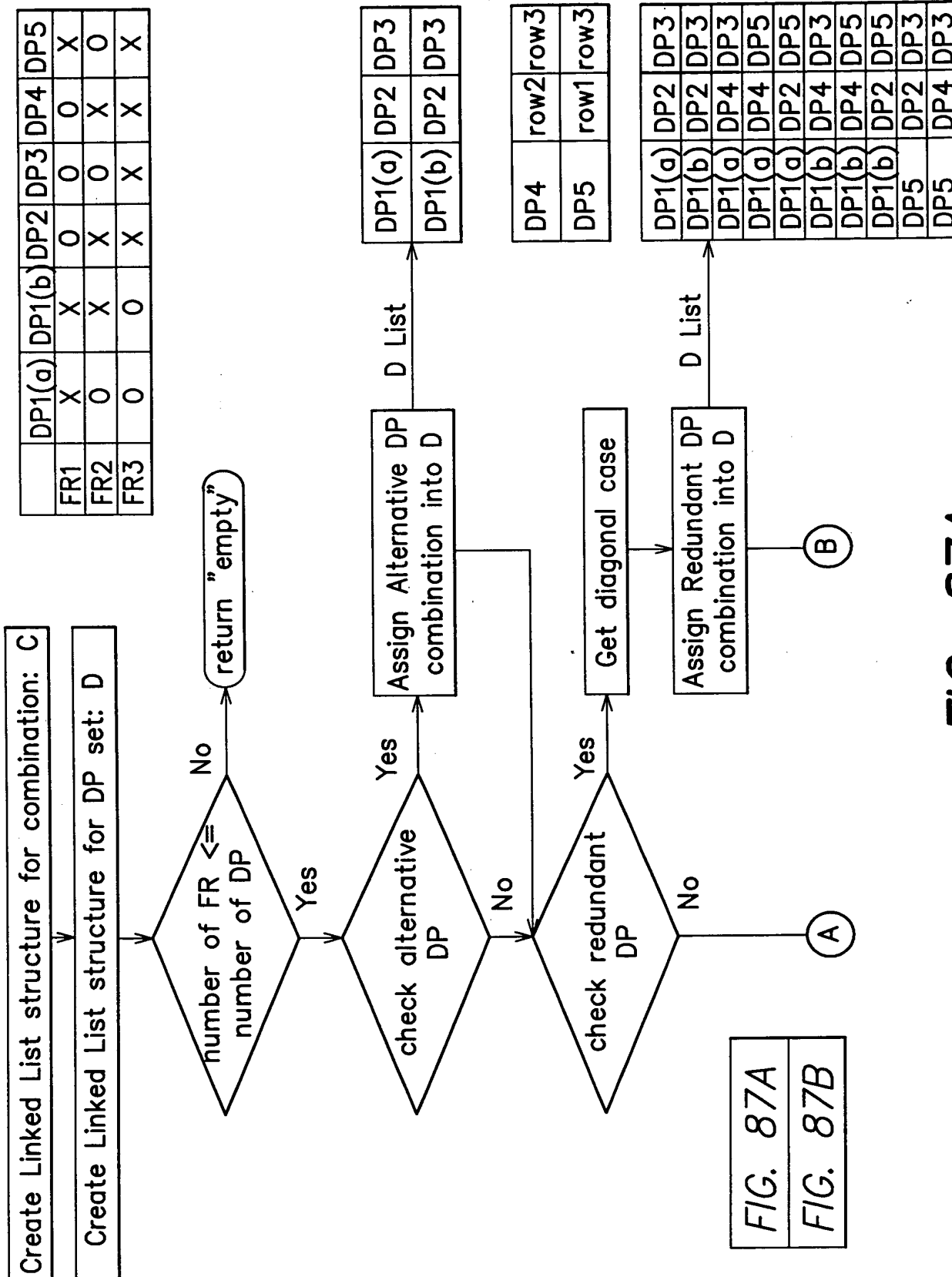


FIG. 87A



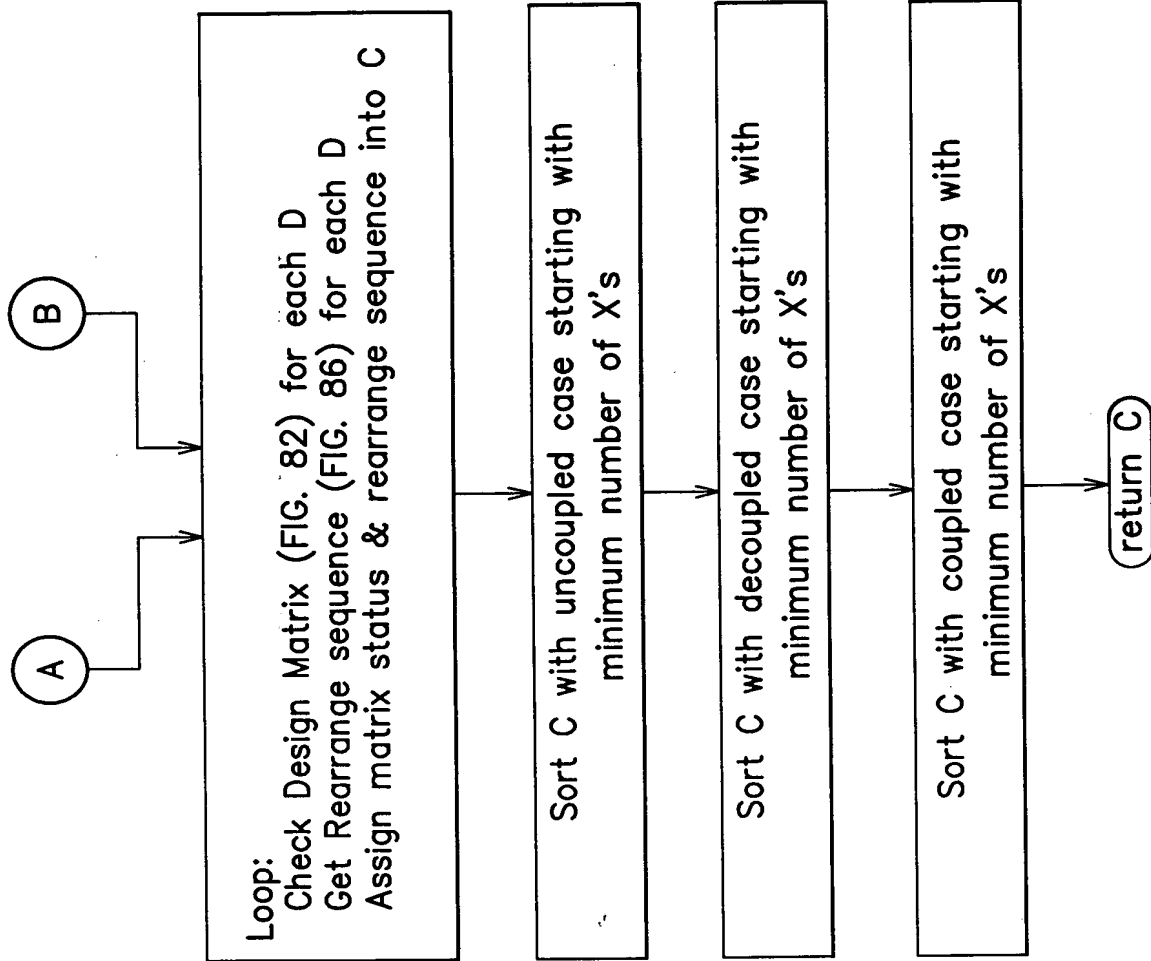


FIG. 87B

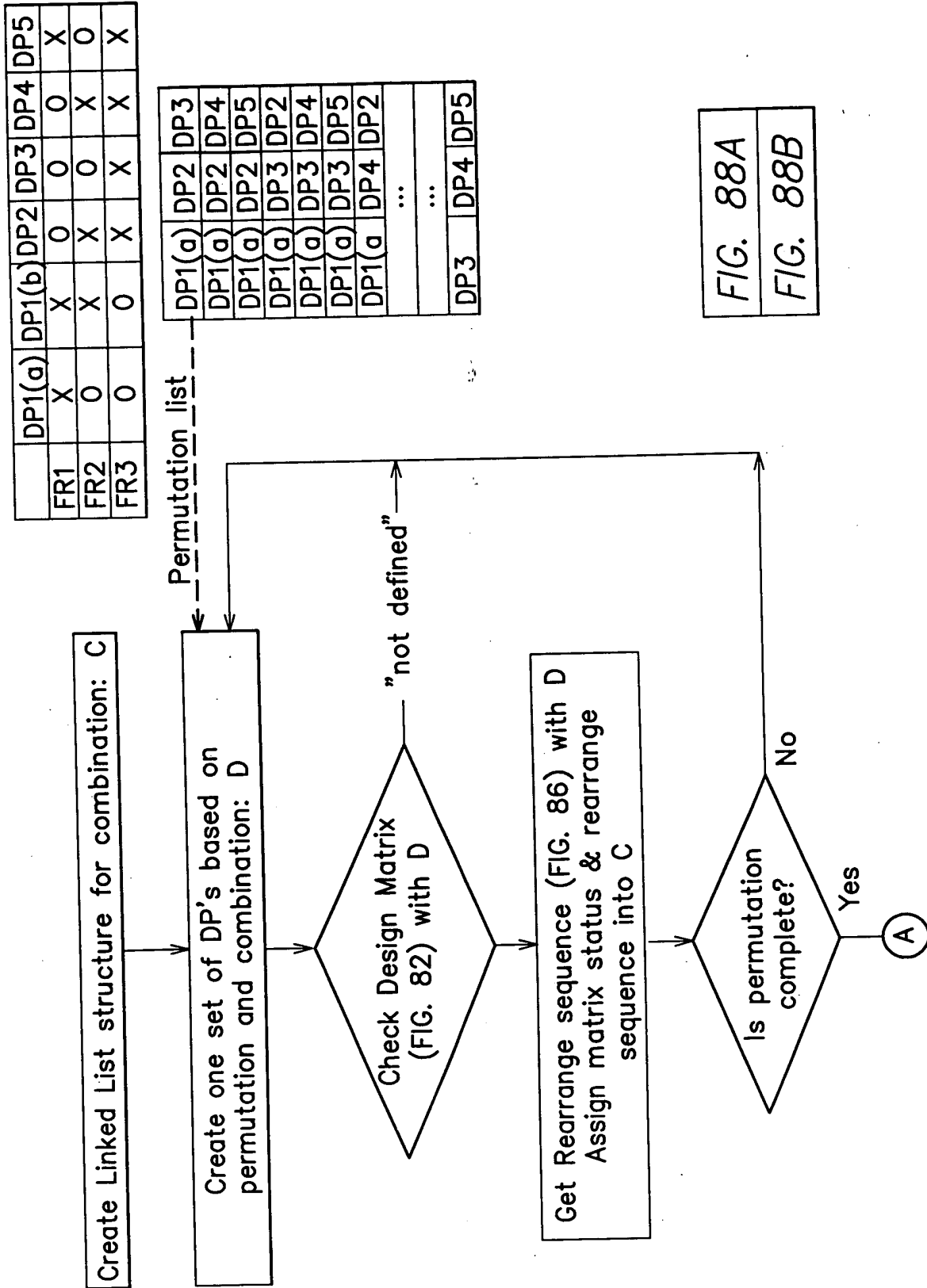


FIG. 88A

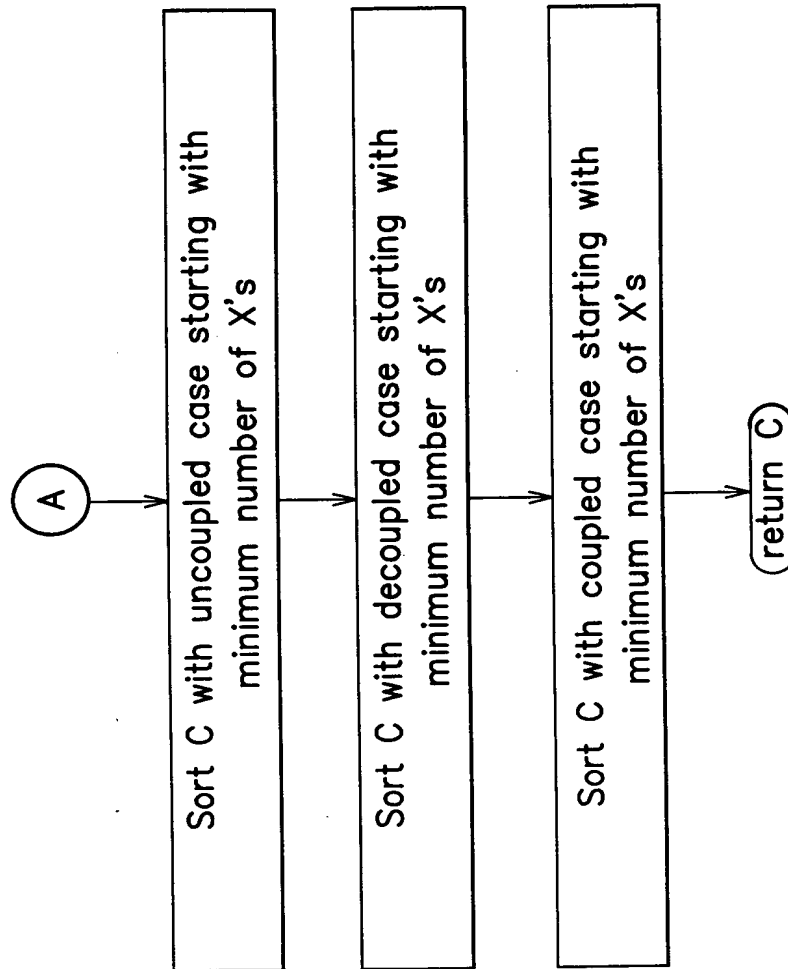


FIG. 88B

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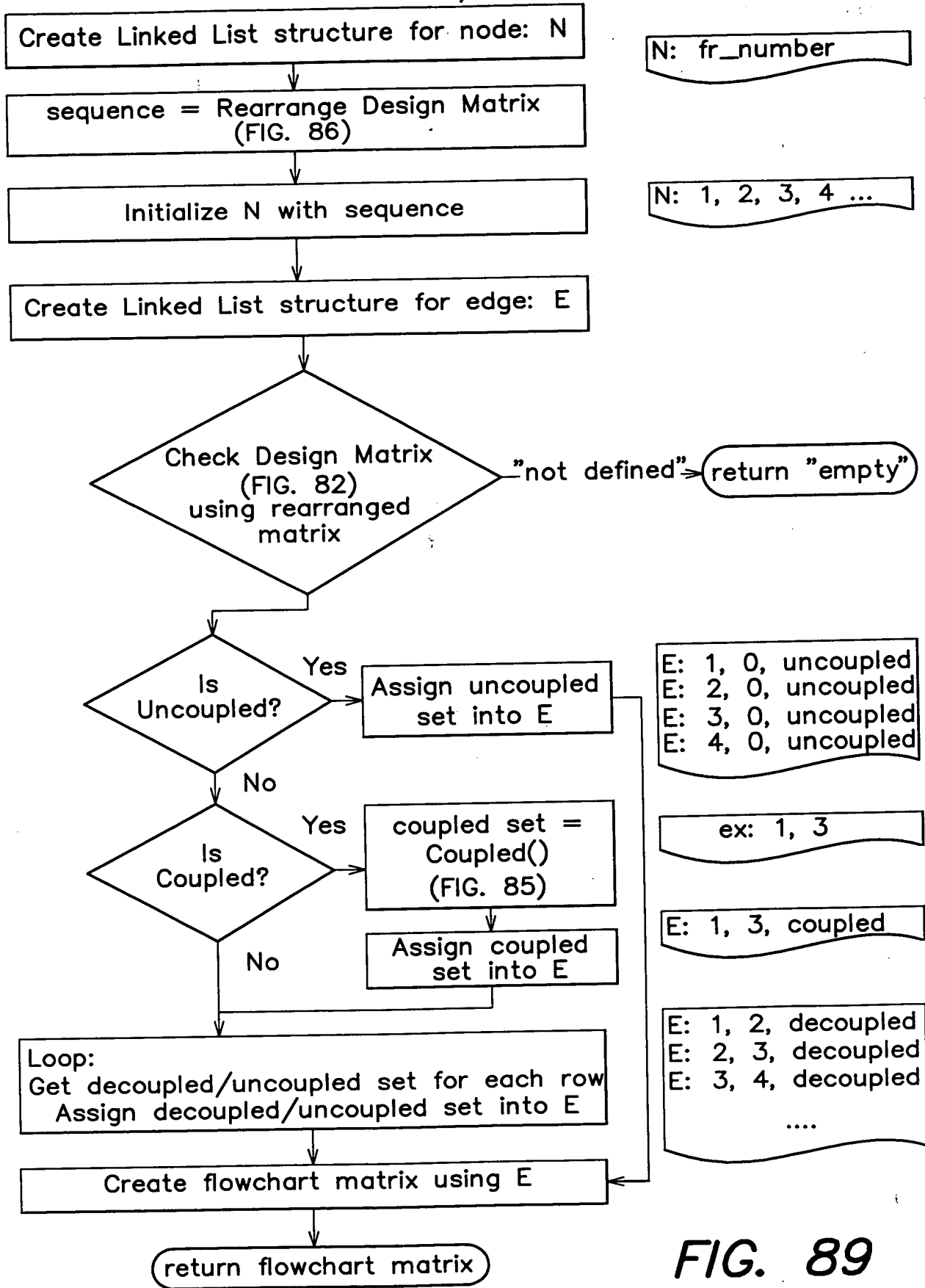


FIG. 89

TOP SECRET

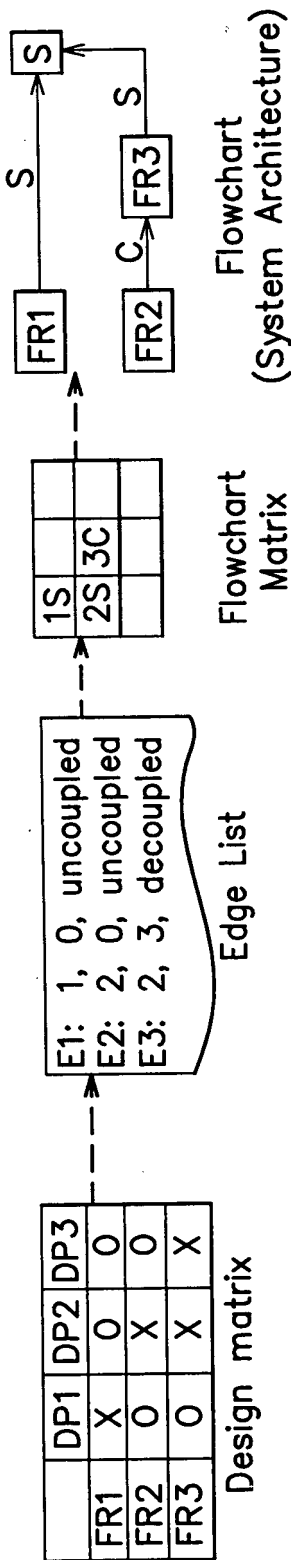


FIG. 90

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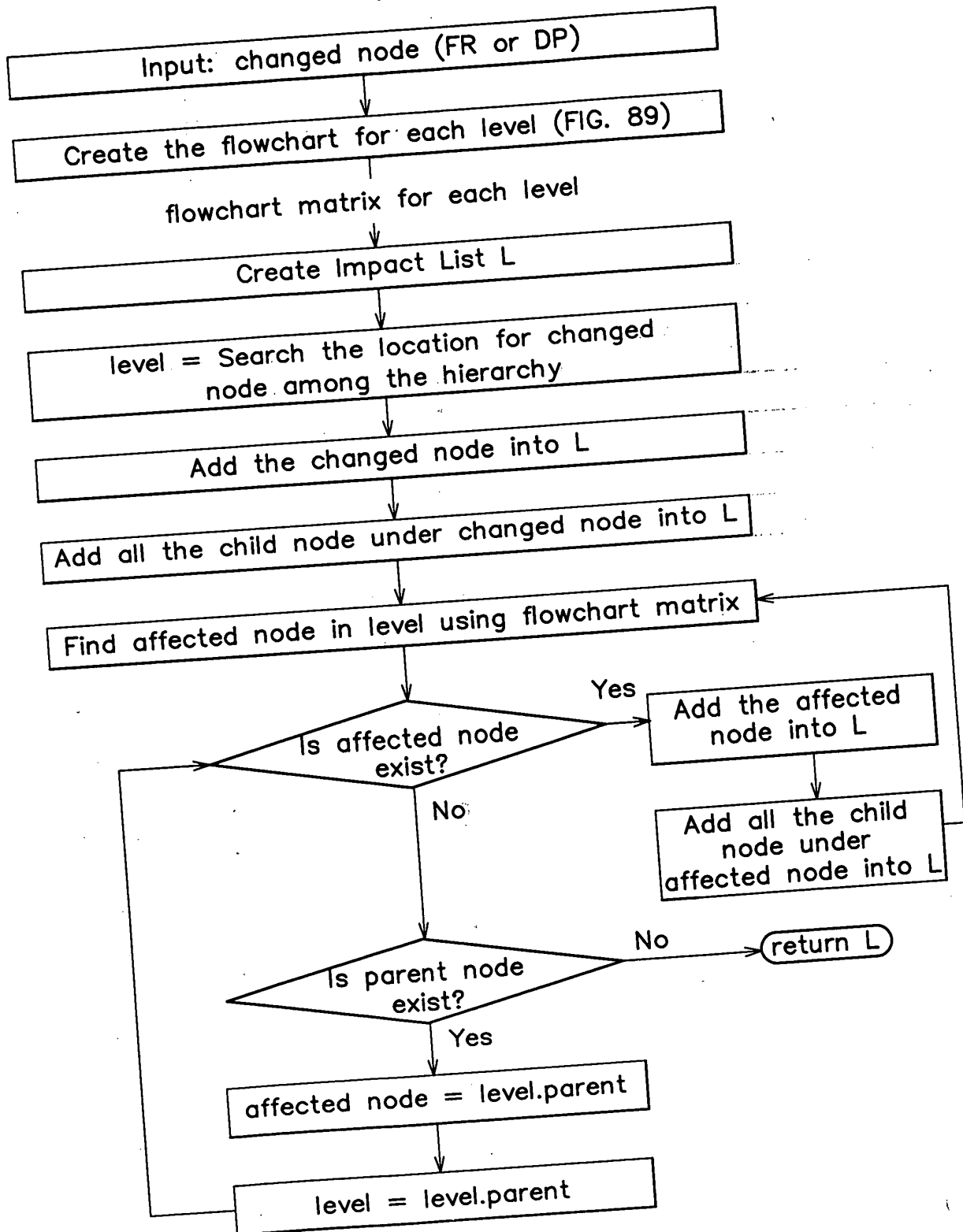


FIG. 91

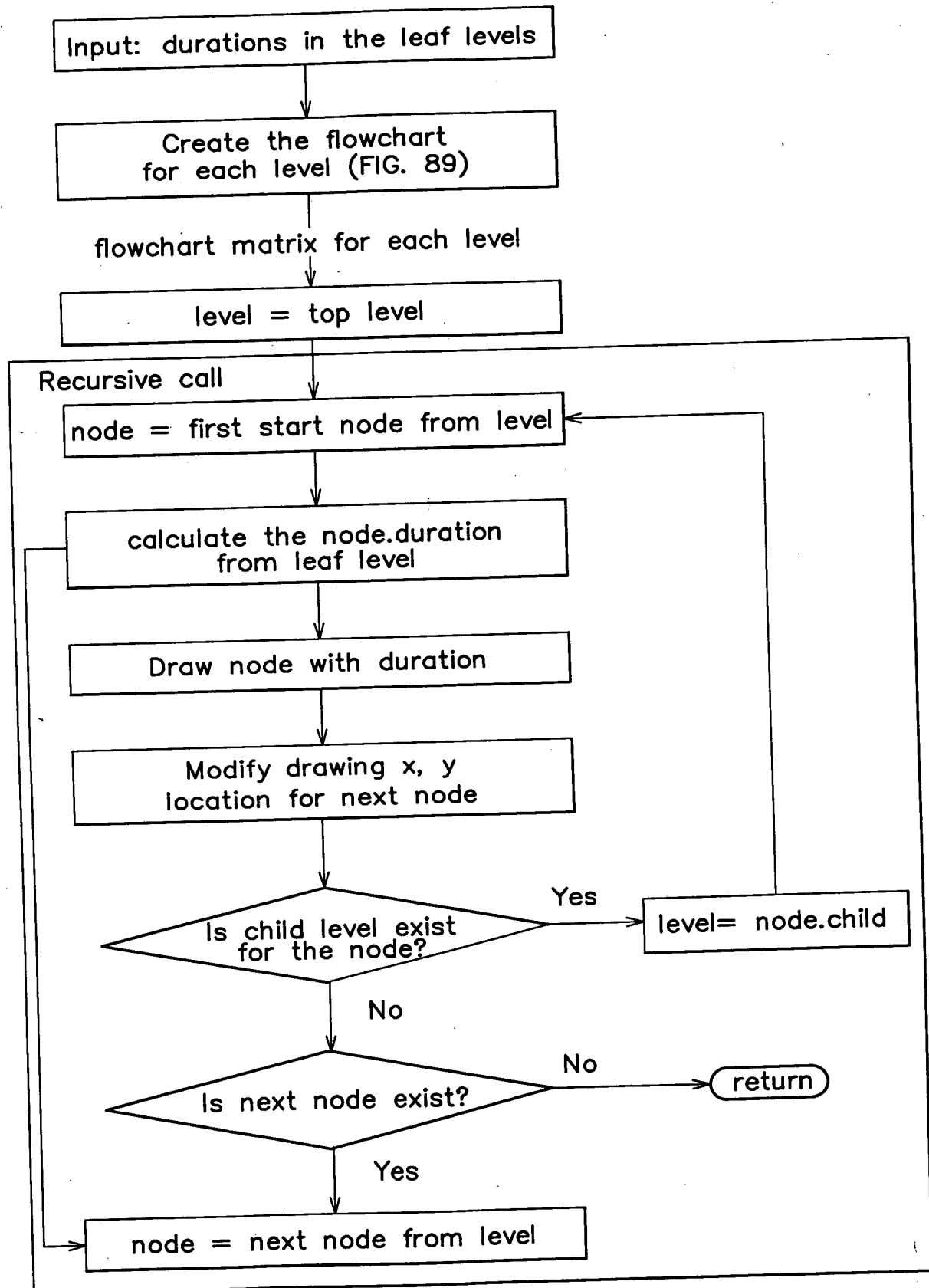


FIG. 92